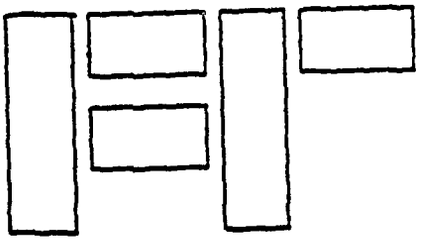
(2)

FASHION INSTITUTE OF TECHNOLOGY

RESEARCH REPORT

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF EXISTING APPAREL TECHNOLOGY

Fashion Institute of Technology



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A student/faculty team investigated three technologies to determine why they were not meeting expectations: AMF Autojig; Union Special Left Fly Topstitcher (J-Stitch) and American Laundry Cabinet Shirt Press. Results indicate various but predictable reasons for lack of successful transfer of technology; right system, wrong application; right system and application, but improper/incomplete operator training; and equipment inadequately designed for application.

Models and checklists for use in determining feasibility of proposed changes or transfers of technology are offered.

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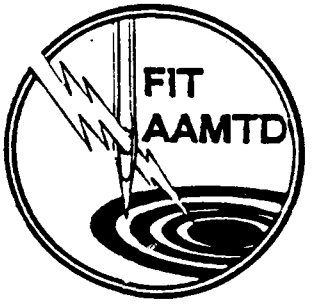
ADVANCED APPAREL MANUFACTURING TECHNOLOGY

FASHION INSTITUTE OF TECHNOLOGY

DLA900-87-D-0016-0007



SENIOR PROJECT:

ANALYSIS AND IMPROVEMENT

OF EXISTING APPAREL TECHNOLOGY

FINAL TECHNICAL REPORT A008

Aaron Schorr
Project Leader

SEPTEMBER 10, 1991

This project has been sponsored by the
DEFENSE LOGISTICS AGENCY
CAMERON STATION
ALEXANDRIA, VA 22304-6100

PREFACE

The intent of this project was to investigate the question of why technology has been slow to be adopted in this country. As I have spent many years involved with manufacturing, I had a personal interest in finding out if some of the ideas that I had were relevant in this area.

As you will see from our report, we did uncover some of the reasons why technology has had its share of problems, but we also feel that we have developed a tool that can assist firms in looking at the whole area of problem solving using feasibility studies.

I would like to thank the several firms who have made significant contributions to this research effort:

American Laundry Inc.
AMF Corporation
Bremen Bowdon Investment Company
Garland Shirt Company
Jos. Pietrafesa Corp.
Triple A Manufacturing
Union Special Corporation

I also want to thank the Fashion Institute of Technology student investigators on this project for all their efforts:

Garfield Duncan, Manufacturing Management
Leslie T. Marr, Manufacturing Management
Carla Miller, Manufacturing Management
Christina Neault, Manufacturing Management
Ada Warrach, Production Management: Apparel

A personal vote of thanks goes to Don O'Brien and his group at the Defense Logistics Agency, Cameron Station, Virginia for their support of this applied research.

Aaron Schorr

September 10, 1991

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF
EXISTING APPAREL TECHNOLOGY

This research report is the result of work performed under sponsorship of the Fashion Institute of Technology and the United States Department of Defense, Defense Logistics Agency (Contract DLA900-87-D-0016).

It is hereby submitted to the DLA office (DPMSO), Cameron Station, Alexandria, VA 22304-6100 in accordance with the Contract Data Requirements List, sequence A008.

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INTRODUCTION

It has often been stated publicly and in written essays that the apparel industry is a collective laggard in the adaptation of modern technology. This has taken on even more importance in recent years with the focus on market driven economies and Quick Response.

For the American Apparel industry to remain competitive with foreign manufacturers it must improve its response to the marketplace, with price and quality. "Quality is consistency. If you don't start right and make it right, you're never going to sell it right in the end."[1] Automation and advanced technology are avenues which when traveled will lead apparel manufacturers to the achievement of these goals. Although capital investment is high, if there is a machine available that will cut your unit cost and improve quality you cannot afford not to have it.

Forward thinking manufacturers who have invested in automation have found that by using high-tech, automated equipment they were able to train inexperienced workers to be productive in a short period of time. By making changes in the look of the plant, the combination of automation and improved aesthetics has resulted in improved productivity and the manufacturers' ability to compete against 807 and import manufacturers.

AUTOMATION

> Automation is the process by which material is automatically moved sequentially from one operation or another until a completed product appears. [2]

Although the apparel industry is a long way from total automation, there have been great strides made toward automating certain sequences of operations and thus deskilling the operations.

Fashion means change and with it an increased need for flexibility. In the past that has been the excuse for not automating, but new technologies have brought forth flexible automation which allows several operations to be performed using the same work station. This flexibility in use will accelerate the return of investment (ROI) and enable small manufacturers to enjoy the benefits of automation.

Flexibility has been greatly increased with the introduction of microprocessors. Computers (which multiply intelligence), when combined with machines (which increase human strength and speed), create a new world of possibilities in flexible automation. The most flexible group of computerized sewing machines are basic machines such as lockstitch, chainstitch, or safety stitch that are not designated for a specific product or operation but are programmable. Those that are fully programmable are classified as "memory stitchers." The operator is able to perform the operation with the machine in the programming mode; the machine's memory will reacall the sequence on demand.

The goal then for future automation in manufacturing is to increase flexibility and productivity while deskilling the process and improving the quality of the finished product.

RESEARCH AND DEVELOPMENT

This is only the beginning. In order for the apparel industry to grow with this kind of thinking "people in manufacturing are going to have to have a closer relationship with machine companies in discussing advancements that could work. Machine companies have got to be willing to react and invest in research and development through their facilities"[3]

Historically, technical innovation has come from small entrepeneurial type businesses seeking to develop a niche in their market. In the apparel industry this type of thinking has been led by contractors and large corporations.

Contractors are in the forefront of the movement to automate. "The typical contracting firm is owned by an individual or family, making it an entrepeneurial type of business. They are attracted to this type of system, and can make a purchasing decision without going through the red tape necessary in larger corporations. When it comes to spending money on equipment that will increase productivity, speed up response time and improve quality, today's U.S. contractors are contradicting the old stereotype of basic machine buyers."[4] The consensus of owners we've talked to is that the payback is a consideration, as is productivity, but above all is quality. If the machine doesn't maintain the desired quality level, they won't buy it.

Contractors have been forced to respond to rapid change with unique utilization of special machine setups, creative folders and attachments, and computerization to control costs and provide a wide ranging array of products. The pressure is on contractors as they compete against the manufacturers, fellow contractors, subsidized foreign trade programs, and foreign sourcing.

A number of large manufacturers have been involved in developing technology behind closed doors. Some of this technology duplicated efforts of others, and some was truly innovative but was never refined to production model status because of the limited nature of the need within a single company of sufficient quantities of equipment to justify moving beyond prototype models. The tight lipped secretive development efforts were aimed at primarily reducing labor time at the needle. These efforts, when successful, actually only served to increase the cost per unit produced as high overhead costs generated by research and development have to be absorbed by insufficient volumes of work. It is also significant that this effort was put forth in the least costly part of the manufacturing process; sewing time through the needles.

While extensive efforts were being made to increase rpms beyond human capability and improve the quality of the seam, the major cost centers - work in process, operator handling, and production control were left far behind. Was it because we found it easier to analyze a machine or action at the needles instead of the whole system? Was it that traditional economic payback analyses dealt with the replacement of like with like and weren't easily adaptable for systems?

"One expert theorizes that the labor intensive apparel industry tends to attract noncapital oriented entrepreneurs. Another theory is that apparel companies have a tendency to wait for someone else to try new equipment and "make sure" that the equipment lives up to its claims."[5]

American manufacturers might follow the example set by a group of French shirt manufacturers. Unable to compete with cheaper Turkish imports, they joined together to form a research company to develop a computer directed, automated production facility. The group - France Chemises - was formally set up in 1983. This is an interesting approach worth imitating as individual manufacturers often cannot afford the high cost of research and development.

In an article on this subject in DNR, Brenda Lloyd reported that "the apparel equipment industry has advanced to the point that small companies such as Fashion Star can afford to modernize ... Management feels that the only way to be successful in our business is to automate ... Our natural advantage (to import competition) is speed and being able to deliver more quickly, and the equipment allows us to do that ... Because of the growth of the company, we have not had to lay off any people because of the automation. They don't worry because they know the automation will not put them out of a job."[6]

Another small manufacturer who has heavily invested in automation is Cal Sport. John Calvert, the president and general manager, expresses the feelings still held by many executives today in a 1987 interview with AIM.

> The foremost factor in making any decision related to automation and capital investments is whether or not the machine will actually improve the quality of the product, and secondly, whether or not the return on the investment will be up to expectation and what it will do from a standpoint of efficiencies and flow... Thirdly, the investment is studied from a utilitarian standpoint - is the equipment specifically for a season, is it something that can be used year-round and will it have the flexibility to be used under different situations and be incorporated into a number of different operations?" ...To successfully automate you have to have someone in senior management that is committed to making it work... then follows financial commitment, commitment to actual physical facilities and commitment to personnel so they understand what your methodology is, what your plans are and why you're doing these things....When shopping for new automated equipment, Calvert is quick to give tried and true manufacturers a certain edge over other competitors. I'm a little bit prejudiced and will go back and invest with them when they come out with a newer model rather than change manufacturers, it tends to make the amount of time you spend in maintenance and repair less economical."[7]

Great strides have been made in the development of new technology. The technology exists to optically scan and measure a customer using video imaging, relay the information along with fabric and style selections to the factory where appropriate patterns will be automatically adjusted to fit the customer, and that information can then be translated into a spread and cut. The garment components can then be assembled and the completed garment sent to the customer within 3 days. This dream of the future is already in operation in Sweden and was unveiled a the 1990 JIAM show as the CLOTHO system and was presented by Juki. Admittedly, made-to-measure is not for all customers, at least not now.

Are we really moving ahead and using all of this technology? Why does it take ten years or more for new innovations to become a part of our way of doing business? Why do firms have to be dragged kicking and screaming into new technologies, such as Quick Response?

The old standby cliches are once again rearing their ugly heads:

> "We're a fashion house we cannot afford technology."
>
> "The labor payback is longer than two years. We only accept ROI's of one to two years."
>
> "We tried that one and it didn't work."
>
> "It's too expensive."

THE STUDY

The overall objective of this project was to look at how effectively technology is being introduced into apparel manufacturing, to see if we are achieving our goals of lowered costs, deskilling operations, and increasing the quality of the finished product.

In our study we have discovered that there are a number of things we should look at to make endeavors into new technology more successful for equipment suppliers and manufacturers.

SYSTEMS APPROACH

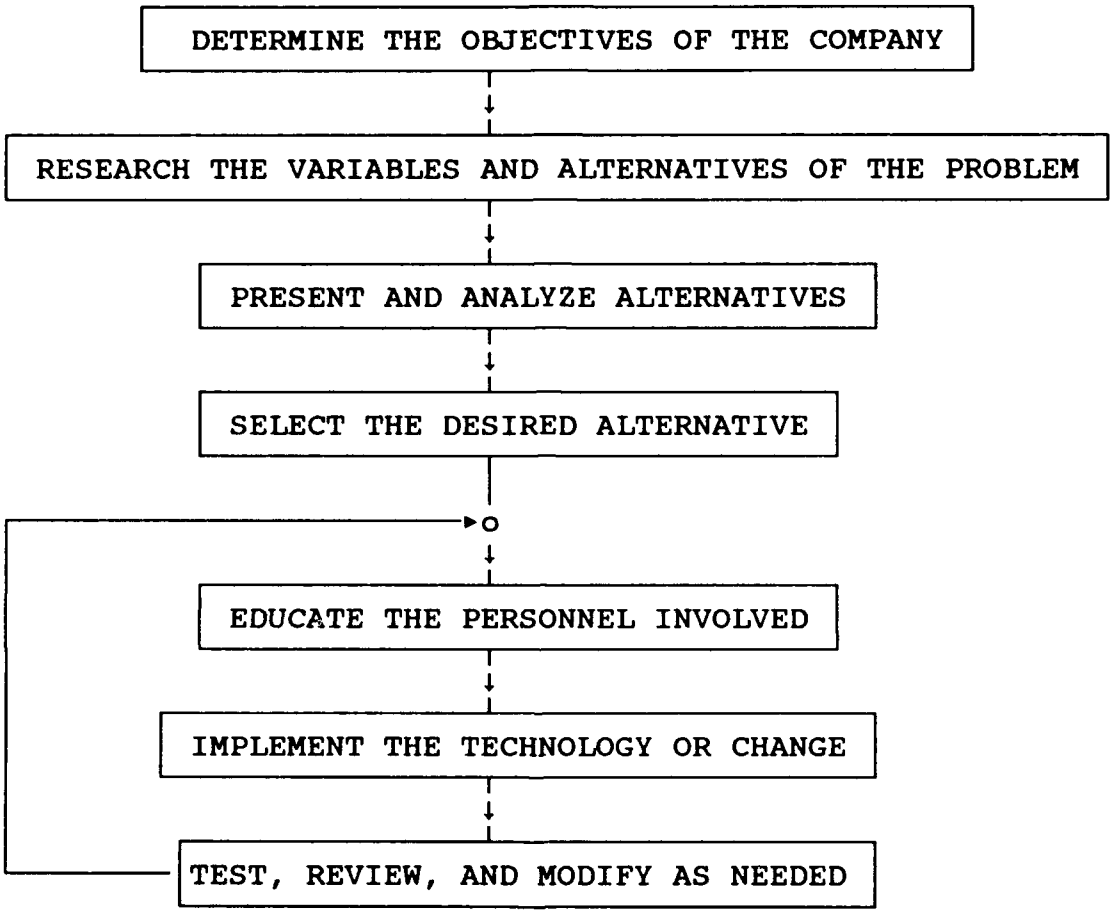
The first system approach to technology in apparel came with the vertical presses in the late Seventies. With these multi station devices we were forced to consider the cost and effects of all our actions in every step of manufacturing from design to raw materials, through spreading, cutting, sewing, underpressing, final pressing, and how we were merchandising to the customer.

Since then we have been gradually introduced to other technologies that have taken the systems approach: CAD CAM integration from design through cutting; unit production systems (an update of the Diamond floor conveyors); the personal computer for real time shop floor management; and, simulation.

The time has come when new investments should be considered on a system-wide basis. The decision of whether to replace equipment should be well thought out and include a detailed study of the alternatives. Manufacturing management must not only manage existing assets; they must also decide when and with what to replace or dispose of equipment. There are two categories of considerations for replacing equipment. Obviously, equipment that is worn out, has excessive downtime and increased repair costs should be surveyed for replacement. Second, equipment that is technologically obsolete should be surveyed. "A good manager should be able to estimate the costs of continuing to use an obsolete or worn-out asset."[8] It is equally important to know the costs of replacing or not replacing the equipment. This should be a constant decision-making process thereby enabling the smart executive to act from knowledge not necessity.

Criteria for costs, quality information, impact on prior and future operations (if applicable) must be clear and quantified in the feasibility analysis. Once there is an understanding of where the company is now, it is important to understand what the future objectives are. This strategy is essential for the implementation of equipment and also for production systems and software. Seeing the whole picture and plan is conducive to change.

We must consider the steps in developing a feasibility study.



In a well managed company this review process is an ongoing affair in an atmosphere that fosters continual evolution of change in all areas of the business.

Once the decision has been made to purchase new technology it is imperative to devise a strategy for the successful implementation of that technology. One area often overlooked is that it is human nature to resist change. Not only do the operators have this resistance, but more critically, management. It is essential that management start with the right attitude toward the change.

Everyone must be made to understand why the decision was made to implement the change. For the successful adoption of any new process careful consideration must be given to the selection of the operator who will be working with the new technology. The operator must be above average with good eye/hand coordination; a cooperative attitude during training is essential; and, the operator must possess the ability to understand adjustments made to the machine. It is imperative that the operator receives proper training and maintains good morale during this period.

We have heard repeated complaints from mechanics that operators are not given time to understand the complexities of these new machines, nor do they receive enough training or are they given enough time to learn how to properly operate them. They are usually just told the sequences necessary to perform their operation, but are not given adequate instruction for what to do if something goes wrong. As a result they often just press buttons in an attempt to fix a malfunction. This creates additional problems for the mechanics who now must attempt to reconstruct the incorrect key sequence that was inputted.

Having a good mechanic(s) is key for successful automation. Whenever possible he or she should be involved in the equipment selection process. The more highly automated the equipment, the more the emphasis will shift from the operator to the mechanic. It is essential that he be sold on the equipment if he is going to help sell the other mechanics and the operators.

The systems approach extends beyond the technology itself to the personnel who will be involved in making the effort successful. Proper planning must take place in forming the team as well as in choosing the alternative to take.

COMPUTER TECHNOLOGIES

Computer driven technologies such as CAD CAM pose additional problems to the user: Difficulty in quantifying benefits; fear of the loss of creativity or identify; fear of being reduced to a machine operator; fear of losing the tools and art of the trade. These concerns can be overcome by education and a properly structured training program.

"Many times the potential of a CAD system is not fully realized because designers are not given adequate time to fully learn the system and fully realize its capabilities. The same challenges were faced by architects, draftsman, automotive

designers and aerospace engineers as they made the transition to CAD."[9] Computer systems or computer aided systems must be user friendly and designed for use by the end user, not the software designer or management level personnel.

Another computerized system which can effect tremendous savings is the unit production system (UPS). "The UPS eliminates bundles, which take up floor space and crease garments, measures performance of each operator, generates hourly production reports, inventory status reports, work-in-process, payroll, line balancing information and individual operator performance and quality reports."[10] One problem, however, has been observed with the UPS. In order for the system to work, all workstations must have operators. If an operator is out for the day, where do you get a replacement? The solutions to this problem at present seems to be running a separate line on a bundle system and pulling the needed operators from that line, or setting up the workstation heads on a turntable so that multiple operations may be performed at one workstation.

Among the computerized systems that are available to manufacturers now are "real-time" production control systems. Data collection devices are placed at each work station in a factory and as each transaction occurs the computer responds instantly. "Because of their ability to generate predictive analyses and to provide immediate decision support for production supervisors and managers, real-time systems can generate savings and benefits by improving production control, regardless of whether conventional, modular or hybrid production systems are in use."[11]

All of this new technology will work to give manufacturers the competitive edge against imports if it is tied together. Technology for the sake of technology won't do. However, there must be a common language among the technologies from different companies. Without this common language, gains from computer integrated manufacturing (CIM) will be limited. The American Apparel Manufacturers Association (AAMA) has been asked to develop communications protocols. "In concept, these would permit all manufacturing machines to talk to one another as part of an efficient production network that will help apparel companies respond quickly to changing market demands."[12] This project is being spearheaded at the University of Southwestern Louisiana (USL) under the sponsorship of AAMA.

EDUCATION

Training materials have historically been a source of frustration for companies seeking to install new technology. Our research clearly shows that manuals must be clear, concise, in non-technical English, and pictorial with clearly identifiable labels. Training manuals utilizing electronic media would be most helpful to avoid unnecessary downtime and service calls. This is particularly true for computer systems where vendors' sales personnel and programmers have a high turnover and where documentation has traditionally been poor and upgrade documentation has been nonexistent. There has been too much reliance placed on memorization in quick training sessions with subsequent retraining by word of mouth or over the telephone.

Training materials should be developed on three levels.

a. Supervisor Level: Explain how the machine or technology works; its place within the overall system; types of skills required to operate it; discussion of special features; limitations and possible problem areas; preventive maintenance; and basic troubleshooting.

b. Mechanic Level: Provide a comprehensive how-to aid on all of the procedures for preventive maintenance, troubleshooting, and rebuilding. (Interactive video programs such as those currently being developed by TC^2 should be expanded further with ways sought to produce them less expensively.)

c. Operator Level: Provide a step-by-step procedural guide on how to use the technology along with suggestions or tips to insure quality output.

SERVICE

Serviceability must be simplified. There is an increasing use of the handyman-type mechanic in our industry because other types are not readily available. As a result techniques must be developed to enable them to easily troubleshoot and repair the new equipment. Some items that should be engineered and designed into new units to achieve this objective are

Self-check systems
Plug in circuits
Modular constructed components
Interchangeability of parts (off-the-shelf spares)
Multiple sources for key components
Convenient service access panels
Limited requirements for preventive maintenance
Simple tools required for repairs on complex systems

MANAGEMENT TRAINING

There is a shortage of qualified apparel engineers. A direct impact of this shortage is the need to increase the role of managers and supervisors in the engineering functions of systems analysis, costing, and methods analysis through a continuing series of company sponsored or industry supported seminars.

It will be increasingly important for these managers and supervisors to attend seminars outside the company, and not rely solely on in-house multimedia training aids. This way they will gain the benefits of exchanging information with others on how to handle human relations and other problems.

ROI ANALYSIS TECHNIQUES

"Today labor represents on average about 35% of the manufacturing cost of apparel in the US. It has been shown in two detailed studies underwritten by DuPont that US apparel makers can be cost competitive with imports when there is automation available to reduce the labor content of the garments....In the apparel industry, a typical sewing machine is run only 25% of the time...that leaves fabric handling operations as the most logical candidate for automation."[13]

"Most manufacturers are no longer justifying their equipment investments through straight-line or double declining ROI methods. Rather they are basing their equipment purchases on a much wider range of intangible considerations...tailored manufacturers calculate such benefits as design and quality improvements, reduced inventories in cutting, manufacturing and warehousing, and quicker turn times."[14]

The time has come to formally adopt non-traditional payback techniques as our standard. It is not fair to look at the price of one component of technology by itself without measuring the real impact on the complete system. The simplistic labor-only analysis still used today has caused us to miss many opportunities through the years because it delivers a distorted economic model which has yielded inaccurate ROI's.

Closer looks should be given to other creative techniques or methods such as the AMCIA analysis currently being developed by Clemson Apparel Research under DLA sponsorship.

SUPPLIER PARTNERSHIPS

It is very important for apparel manufacturers to develop a close relationship with their equipment suppliers. Many manufacturers rely on trade shows and equipment trials as their information source for technology. Suppliers have historically developed equipment based on the perceived requirements of customers. Perception is a very expensive method of research and development and has not always yielded success.

Equipment suppliers of today are often engineers and many firms have personnel with apparel industry manufacturing experience. When high technology is to be introduced into a plant it will usually bring with it a set of new, unforseen problems. An experienced supplier can be an invaluable resource for successful planning and problem-solving.

A company should "review any requirements with the vendor and determine the best way to supply the missing elements ... Include all changes and/or developments agreed to by the vendor as part of the written contract. This helps prevent any misunderstanding after a contract signing...Determine the proper timing for the installation. This includes consideration of the peak parts of the season, availability of equipment, and the availability of people...When the contract is signed, the installation timetable set, and the equipment ordered, prepare a detailed installation plan."[15]

Suppliers must take the time to learn how technology is going to be used. Developing new products that are more sophisticated and which run at speeds equal to or less than current simpler machines is not a productive use of resources. The arguments

that they deskill the job or improve the consistency of quality are not enough. No one can afford to purchase the equipment if it doesn't at least equal or surpass current levels of productivity.

Supplier support is essential for success. Local assistance, customer service, knowledgeable distributors, and trained technicians are essential to bolster the use of new technology in industry. Companies failing to develop their backup will soon have product lines that are non-sellers. Just look at the recent experience with programmable sewing machines. How many are now operating as plain sewers?

Suppliers currently maintain lists of equipment sold and their features. Where is the follow-up when modifications are developed? Where are the marketing programs that incorporate follow-up training, repair kits, and suggested local replacement parts for frequently needed items?

Mechanics, supervisors, and operators do not remain in their jobs forever or retain all that is taught to them on an initial visit. It is accepted that we retain 70% of what we are shown. By the third exchange of verbally instructing each other, we are learning 34% of what we need to know. This is extremely critical when it comes to computers or computer driven equipment. Special features that we planned and paid for may not be utilized because the information that is transferred from current employee to new hire is only that which is necessary to do the job. The understanding of why or how it all fits together is lost through reliance on partial recall and lack of documentation that has occurred with upgrades.

CONCLUSION

With the successful implementation of new technology we can enjoy many benefits:

Increased productivity.

Improvement of

a. Quality
b. Product
c. Information
d. Communication.

Upgrading of the image of the industry as a good place to work.
Meeting the needs of the Quick Response business environment.
Gaining from the improvement of worker morale through management's commitment to the future of the company.

"Many types of mechanized equipment actually improve flexibility in that they allow for a sudden change in work loads that could not be achieved under the traditional methods of production. Expensive new machinery somehow stimulates more careful and systematic management."[16] For technology to be integrated effectively in all levels of our industry we must develop a more cohesive partnership between developers and users. As a model we should look to retail operations which have begun to adjust to market driven merchandising through Quick Response. Utilization of this model of partnerships between apparel manufacturers and their equipment suppliers will lead to faster acceptance of technology and a better allocation of limited resources.

The next section of this report details the project team's experiences with three varied technologies: the Union Special J Stitch machine used for stitching down the left fly on mens/boys pants; the AMF Autojig for front body panels on tailored jackets; and the Ajax Shirt Cabinet Press. The sequence of events described in this section is applicable to many other situations we have encountered as they involve operator methods, application of technology, productivity, and quality of the finished product.

THREE TECHNOLOGIES

AMF'S AUTOJIG

INTRODUCTION TO TEMPLATE SEWING

Automated template sewing is a unique concept of profile stitching of garment components. The operations in which it may be used range in size from pocket flaps to complete topcoat fronts. The first templates introduced were used for small parts such as pocket flaps, collars, and tabs and met with great success in the United States. The introduction of templates for large parts has been successful throughout Europe but has not caught on in the United States. Template sewing aims to deskill the sewing operations while increasing the consistency of quality. A successful machine and proper template will shorten the throughput time, improve quality, and reduce training times for new operators.

The installation of a typical template sewing operation begins when the apparel manufacturer supplies the equipment vendor with sample parts and garments for evaluation. The vendor will then fashion the initial set of templates and any adjusting mechanisms that may be necessary for larger parts prior to the installation of the equipment in the apparel plant. Initial adjustments are normally the responsibility of the vendor. The vendor may also explain how the manufacturer may make other templates in the future or set up procedures to have templates made by the vendor for subsequent style changes.

Template sewing of large parts, specifically jacket fronts in this project, deskills a difficult operation. The operator's function is to load and place the template for the machine to automatically sew the components and to unload the template when the parts have been sewn. The click lapel and fronts operation are eliminated by having an automatic trimmer on the template sewing machine. First baste facing and pull first baste are not required as fullness is automatically inserted by the construction of the template and the way material is placed and clamped in the template.

Sewing around the front edge and attaching the facing is the second most crucial operation to perform on a jacket. By semi-automating this operation it is guaranteed that the amount and location of fullness is correct and that the profile meets the designers' specification. By correctly completing this operation at the beginning of jacket assembly the subsequent operations can be performed with greater ease and higher quality and productivity.

Template sewing used in sewing jacket fronts replaces four manual operations:

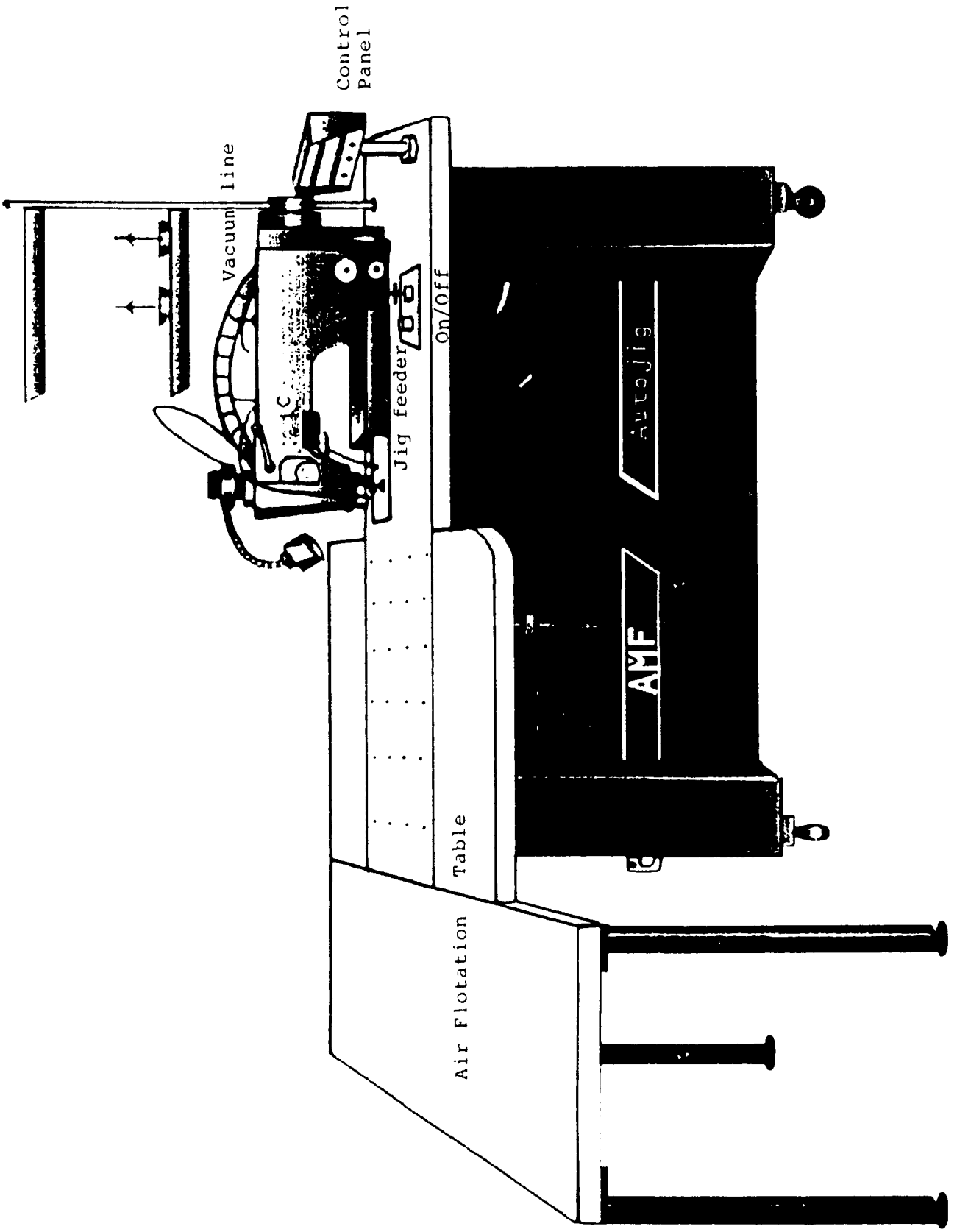
OPERATION	S.A.M.*
Click lapel and fronts	.648
First baste facing	.886
Sew front edge	.392
Pull first baste and pair in	1.201
*Standard Allowed Minutes	3.130

The full cycle of template sewing a jacket front, including bundle time, template changes, automation incentive, and personal fatigue and delay, takes about one minute. Therefore, the template method takes one third the time of the manual method.

AMF AUTOJIG 84054 USB

The AMF Autojig 84054 USB is used in template sewing of jacket fronts. It uses a Pfaff 480 lockstitch with automatic underbed trimming and disconnectable cloth trimming knife. The 84054 is equipped with air flotation which supports the larger operation. It is rated as being capable of producing 480 pairs of jacket fronts per day. The sewing operation works with two templates that are constantly in the process of being loaded, sewn, and unloaded. The templates are designed for a specific style or size range. The Autojig workstation is designed with storage shelves for additional templates. Changing or adjustments of templates may be accomplished in a matter of seconds.

AMF AUTOJIG


Control Panel
Vacuum line
On/Off
Jig feeder
AutoJig
AMF
Table
Air Flotation

BREMEN BOWDON AND THE AMF AUTOJIG

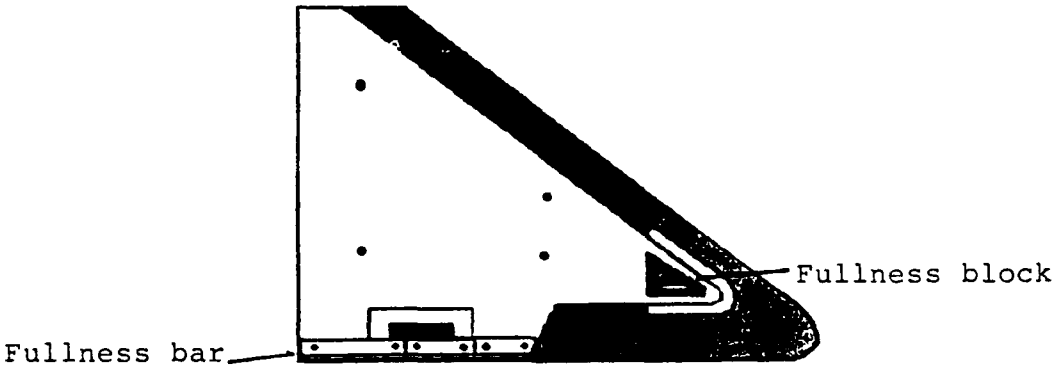
Bremen & Bowdon Investment Company (BBIC) is a cut to order manufacturer employing over a thousand operators. They produce 12,000 to 13,000 suit and sport jackets and 8,000 pairs of pants per day. They frequently have several fabric variations within a bundle. BBIC has successfully used the AMF Autojig for small parts for several years. Mr. John Cook, President of BBIC, first saw the Autojig for jacket fronts in operation at the 1988 IMB Show in Cologne, West Germany. Mr. Cook saw the possibility of improving quality and deskilling the operation and thereby saving labor cost and training time. He decided to purchase the Autojig while at the Show.

When you study the design outlines and fabric behaviors you begin to see that each causes the garment panel to be sewn in differently to accommodate varying amounts of fullness. As examples, consider wool serge, where the fullness can be easily pressed into the correct shape, and cotton seersucker, where fullness does not press out as easily.

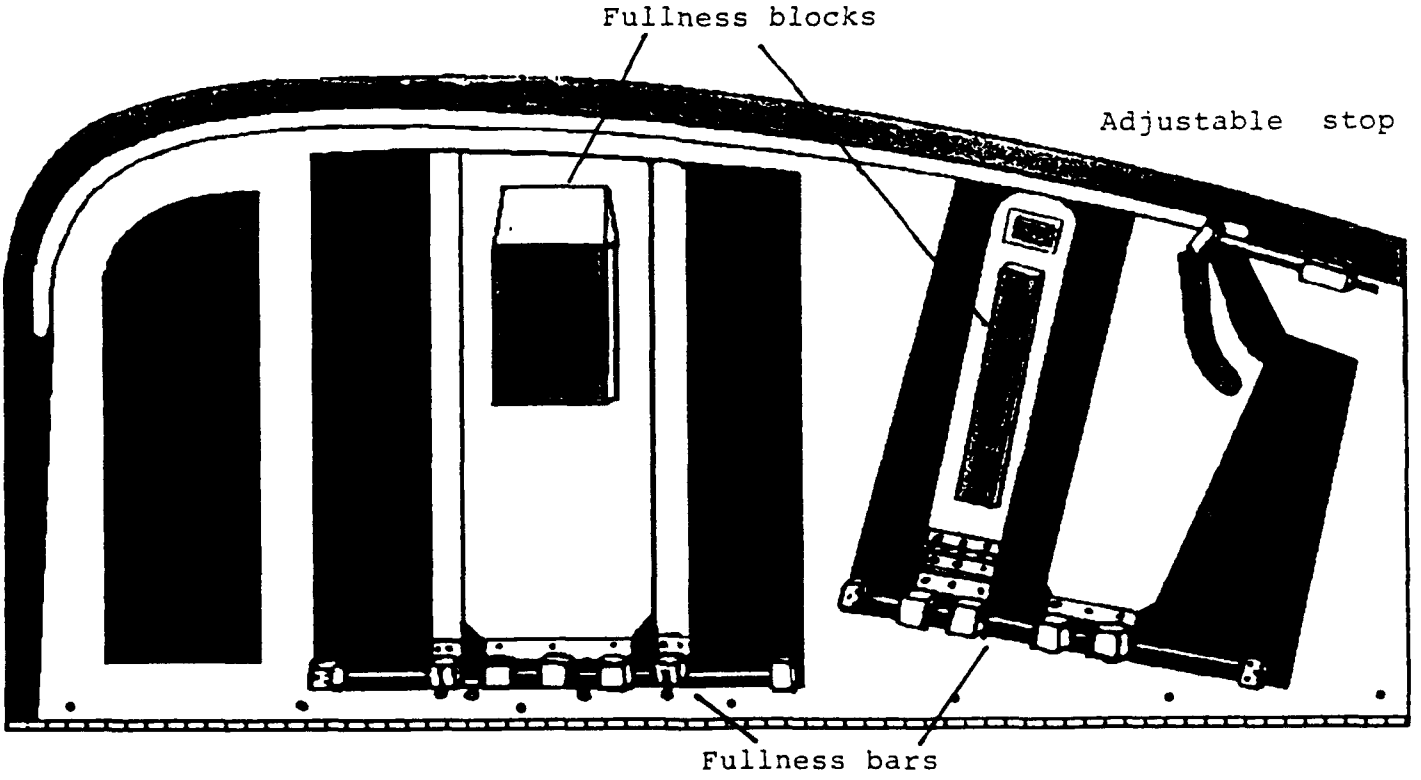
The production process at BBIC requires having a variety of fabrics within a bundle (bundle normally consists of up to 18 pieces). Different templates were made to sew the variety of fabrics. Initially, the company thought that they would only need to change the template for style variations, but they soon discovered that that was insufficient. The operator would need to adjust the fullness bars in the template from cycle to cycle. If we were to ask the operator to readjust the template then we would be defeating the purpose of the Autojig by reintroducing higher skill requirements.

AMF TEMPLATES

TEMPLATES



COLLAR TEMPLATE



JACKET FRONT TEMPLATE

SUMMARY

Under the right conditions, such as the manufacturing of military uniforms or European production where large lots of the same or near same weight fabric are run, this piece of equipment would be ideal. In the case of cut to order manufacturing this workstation is not recommended as it requires reliance on an operator's judgement to determine when to change a template or make other adjustments.

Since BBIC had good prior experience with the vendor in other applications and this version, at least on paper seemed to work well, no problems were anticipated at the time of purchase. Problems did, however, show up in production. Upon analysis they were not in the mechanics of the system but rather in the application of the system to a production plan that does not permit the proper workflow that can take advantage of this Autojig.

UNION SPECIAL'S LEFT FLY TOPSTITCHER

INTRODUCTION TO LEFT FLY TOPSTITCHING

There are times when we integrate a new technology into manufacturing and reach a premature plateau in productivity. Such was the case with this operation, and our research sought to uncover the reasons for the possible quality and productivity deficiencies of this operation.

UNION SPECIAL 2800 E-4J

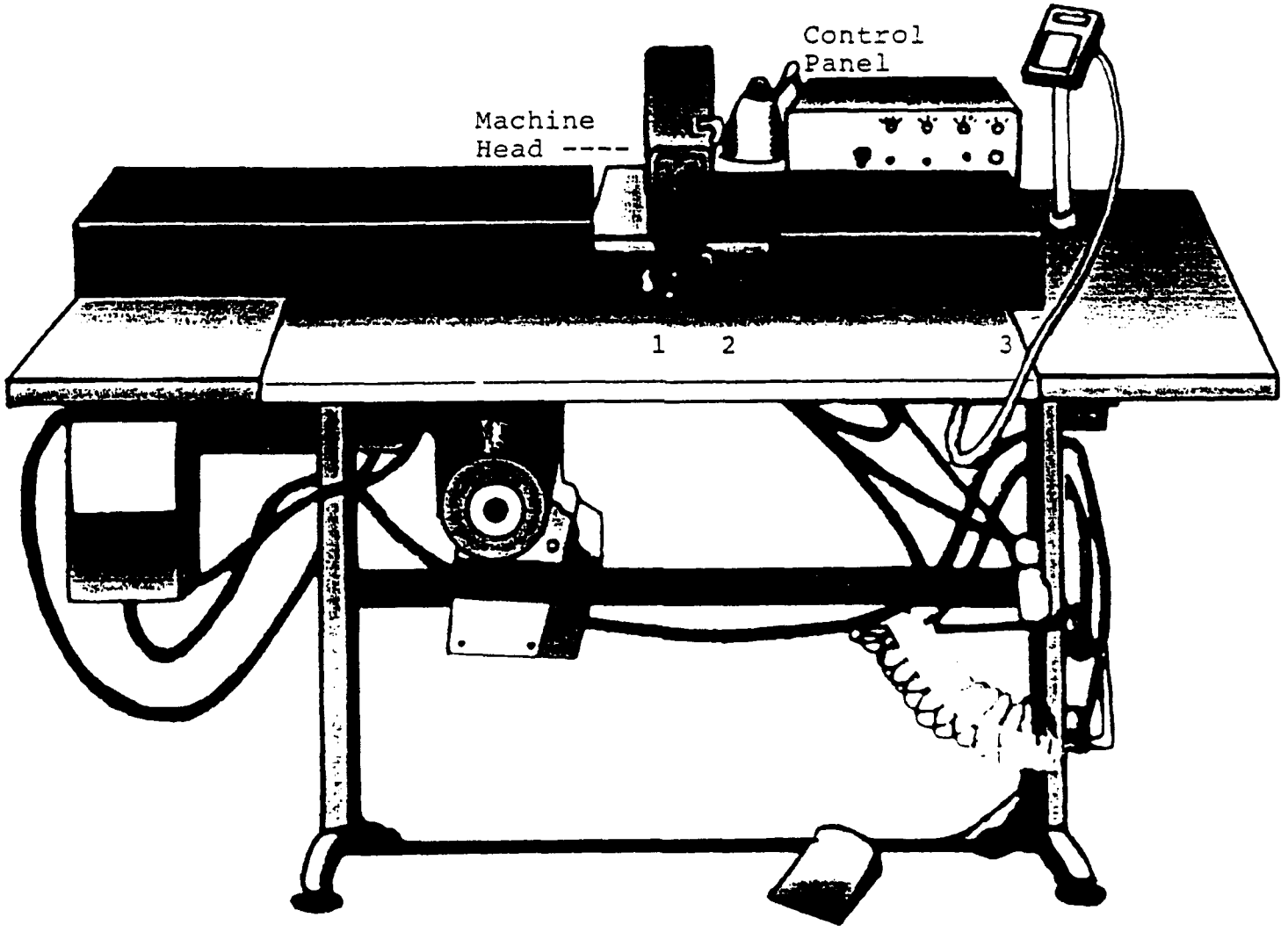
The Union Special Left Fly Topstitcher 2800 E-4J (J stitch) is a semiautomatic sewing machine designed to topstitch the left trouser fly of pants. This concept was introduced in the early 1970's. Modifications and improvements in design were made in 1972 and 1979. The latest revisions and current machine design with controls (made in 1984) were necessary to keep up with the growing changes in the electronics field.

The Union Special J Stitch deskills a difficult operation; it is equipped with an automatic sewing function. The operator loads the left fly and lowers the clamp by pressing the treadle. The machine will then back tack at the beginning of the operation if desired, automatically sew to a point that is photocell controlled, then will backtack if required, and cut threads. At the end of the sewing cycle the clamp automatically lifts and the needle returns to the starting position. The operator is required to load and unload the J Stitch, or the operator can be assisted by an optional unloader.

Topstitching the left fly is a highly skilled operation when performed manually; the curve must be stitched without puckering or irregular stitches and the line must remain parallel to the center front edge of the fly.

By semi-automating this operation and following the manufacturer's suggested method, consistently high quality and high production levels can be achieved by an unskilled operator on a range of different materials.

UNION SPECIAL LEFT FLY TOPSTITCHER



1: Needle position.

2: Position bottom of fly here in clamp.

3: Waist of pants is at this position.

GARLAND SHIRT COMPANY AND LEFT FLY TOPSTITCHING

The Garland Shirt Company in Garland, N.C. manufactures men's trousers in addition to manufacturing shirts. Garland was experiencing a quality problem with their J Stitch operation which has been on line for three years. Once the fly was stitched the fabric rolled at the bottom of the fly instead of lying flat. This created a poor quality garment. The level of production was satisfactory for their then current needs. However, they were looking to increase production and would therefore need to increase their output on the J Stitch.

At Garland Mr. Bill Sand, Chief Engineer, and Ms. Edna Smith, Trousers Supervisor demonstrated the quality problems they were experiencing with their J-stitch operation. We observed the operation, made time studies, videotaped the operation, and interviewed personnel in order to collect data for analysis of the methods being used to sew on the J-Stitch.

The last attempt to improve the operation was in 1988. At that time the mechanics changed the rubber tracking on the clamp. Also, the automatic thread cutter was disengaged because the mechanics felt that it caused unthreading in subsequent sewing cycles.

Three utility operators sew on the J Stitch machine. Method studies were performed using their most experienced operator. This was then compared with the recommended method in the Union Special manual. The two methods varied: The Union Special instructions suggest placement under the clamp from left to right (although loading methods may vary for efficiency and comfort). The left fly is to be positioned to the needle with the left hand about one inch to the left of the starting point. The material is then to be stretched slightly by holding the left hand stationary and moving the right hand to the waist. The complete left and right hand analyses are illustrated on the following pages.

LEFT AND RIGHT HAND ANALYSIS

GARLAND SHIRT COMPANY

J STITCH METHOD

LEFT HAND	MACHINE	RIGHT HAND
UNTIE BUNDLE	IDLE	UNTIE BUNDLE
DISPOSE BUNDLE TICKET	IDLE	DISPOSE BUNDLE TICKET
PICK UP LEFT LEG & BRING TO CENTER OF BODY	IDLE	PICK UP RIGHT LEG & DISPOSE TO CART AT RIGHT
SQUARE WAISTBAND CORNER	IDLE	SQUARE WAISTBAND
ADJUST FOLD AT CROTCH	IDLE	HOLDING WAISTBAND
PLACE GARMENT ON TABLE & SLIDE TOWARD CLAMP HOLDING CROTCH	IDLE	PLACE GARMENT ON TABLE SLIDE TOWARD CLAMP, POSITION WAISTBAND TO EDGE GUIDE
POSITION CROTCH TO NEEDLE	IDLE	STABILIZES WAISTBAND
STABILIZE GARMENT	CLAMP CLOSED	STABILIZE GARMENT
HOLDS CROTCH	SEW	HOLDS WAISTBAND
HOLDS GARMENT	IDLE	CLIPS THREAD
DISCARD TO RIGHT	IDLE	DISCARD TO RIGHT

LEFT AND RIGHT HAND ANALYSIS

UNION SPECIAL

J STITCH METHOD

LEFT HAND	MACHINE	RIGHT HAND
POSITION FLY TO NEEDLE HAND IS ONE INCH TO LEFT OF STARTING POINT	IDLE	HOLDING GARMENT
MAINTAINING POSITION	IDLE	PIVOTS FLY TOWARD CLAMP THUMB APPROX. TWO INCHES FROM EDGE
MAINTAINING POSITION	IDLE	MIDDLE FINGER STRADDLES THE CLAMP AND HOLDS THE FRONT EDGE INSIDE CLAMP
STATIONARY	IDLE	MOVE HAND TO RIGHT SLIGHTLY STRETCHING FABRIC
STATIONARY	CLOSE CLAMP SEW	STATIONARY

Information obtained through telephone discussions with Union Special representatives suggested that the rolled fabric at the fly bottom may be related to the type of material, the construction of garment, clamp pressure, or the number of stitches per inch. Possible causes for unthreading of the needle on subsequent cycles may be related to the tension release mechanism, needle disengage timing, or the way the machine is threaded. This information was forwarded to the mechanics of Garland.

We obtained a video tape from Union Special and compared its method to the one in the manual. Although the loading methods were the same, we noted that Union Special had developed an optional automatic unloader in 1982, which allows the operator to free her hands of the operation in process to prepare for the next operation. (Garland, we learned, had not been informed of this option). However, the method that was demonstrated on the videotape worked with unpaired bundles of left fronts only. At Garland, left and right fronts are bundled in pairs.

To complete our evaluation we had to compare the paired and unpaired methods to determine if it would be possible for Garland to use the automatic unloader without changing their production methods. For this purpose Union Special loaned an automatic unloader to the Advanced Apparel Manufacturing Technology Demonstration (AAMTD) lab at the Fashion Institute of Technology (F.I.T.) for installation on their J Stitch machine.

In order to make the comparison of paired and unpaired bundles, it was necessary to prepare representative bundles and sew them under simulated in-plant production conditions. Time studies were taken, and the results were compared with information obtained from the Karat System, a computer-based software package that gives elemental times allowing an engineer the opportunity to synthesize the time required to perform a sewing operation. The time studies indicated that there is almost no time difference in performing the operation with paired or unpaired bundles; the cycle time of the machine is long enough for the operator to discard a pair of left and right trouser fronts.

When working with bundles of left fronts only, the time used to dispose of one left front and pick up and position a second left front is approximately 50% of the automated sewing time. When working with paired bundles the dispose and pickup operations of left and right fronts require approximately 85% of the automated sewing time. Regardless of which method is used, the manual work is completed within the sewing cycle. An operator has less idle time with paired bundles.

To take advantage of this new technology and follow the recommended method, it would be necessary for Garland to change their method of production.

SUMMARY

It is the opinion of the project team that in technologies of this type the critical concern is the proper loading of the part into the clamp. It is important to remember that this automated technology replaces a highly skilled operation and that all of the intricacies have not been removed. It is incumbent upon the supervisors to follow-up on the methods being used by operators to insure first quality standards. In automatic cycled machines first quality performance will also yield the sought after productivity.

When considering modular manufacturing units in the future, management must be aware that multiple operators must be cross-trained on this type of operation. This leaves many more opportunities for poor performance as operator training tends to be abbreviated in the modular environment. The little details and techniques that are crucial to the successful operation of this type of technology must be reviewed and spot audited by the supervisor. Failure to do so will cause the quality of the unit to fall substantially as these operations are quick and someone with poor methods can affect many units in a short period of time.

We recommend to equipment vendors and apparel manufacturers alike the videotaping of proper operator methods and making the tapes available to operators-in-training and to supervisors in order to help to alleviate this type of problem in the future.

AMERICAN LAUNDRY'S CABINET SHIRT PRESS

INTRODUCTION TO SHIRT PRESSING TECHNOLOGY

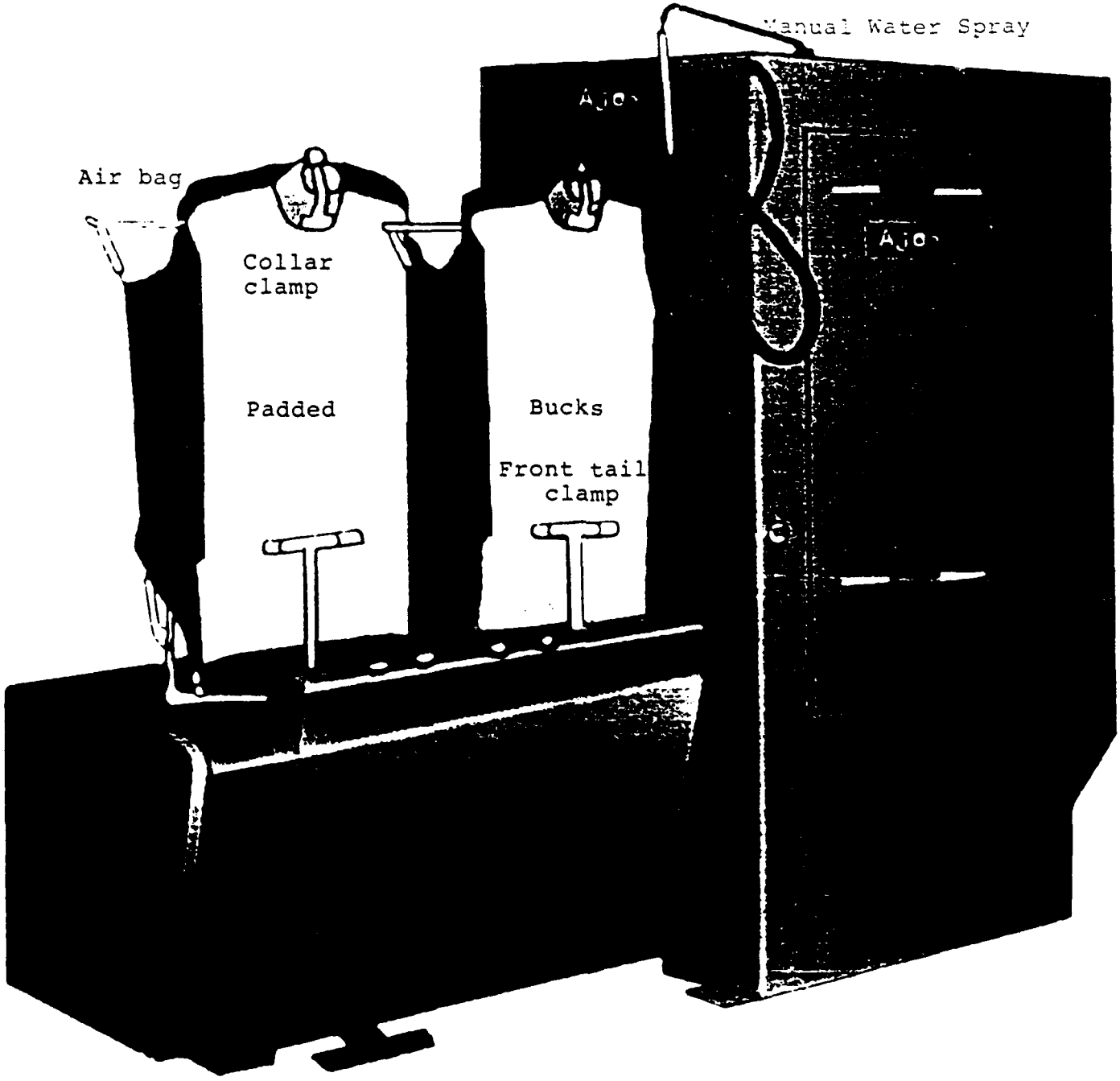
In the manufacture of men's shirts, finishing is an area where production time can be greatly reduced by the use of advanced technologies, one of which uses a cabinet shirt press which has two bucks. A shirt is loaded onto one buck and then is sent into the cabinet. There it is sprayed with water and pressed by two heated plates (one in front of the buck and one behind) which move forward and press against the loaded buck. While the first buck is in the cabinet the operator loads the second buck. Prior to pressing the body of the shirt in the cabinet press, the collar and cuffs are pressed at different stations. This project concerned the performance of a cabinet shirt press operating in the Garland Shirt Co.

AMERICAN LAUNDRY'S AJAX DOUBLE BUCK CABINET PRESS

The Ajax Double Buck Cabinet Press (Model DFB) is manufactured by American Laundry Machine Inc. The DFB is designed to press the entire front, back, and yoke area of a wide range of shirt styles and sizes. The DFB comes with two standard 18 inch bucks. In addition to the standard buck there are eight interchangeable, different sized bucks that may be ordered for the press. Shirts are held on the buck by two clamps, one at the collar and one at the front shirt tail. Before entering the pressing chamber the shirt is sprayed with water by the operator by means of a hand-held sprayer. Additionally, the shirt may be sprayed by an optional, automatic sprayer located inside the chamber. The bucks are equipped with air bags on both sides and at the yoke. Once inside the chamber the air bags expand to smooth out the wrinkles before the heated heads press the front and back of the shirt.

The operator is responsible for loading and unloading the bucks, hand spraying the shirt before it enters the chamber, and activating the pressing cycle that will move the bucks in and out of the chamber. The machine is responsible for automatically spraying the shirt once inside the chamber, if so equipped, and for pressing the body of the shirt.

AJAX CABINET SHIRT PRESS



GARLAND SHIRT AND THE DFB

The Garland Shirt Company produces top quality men's shirts in 100% cotton, including pima cottons. They were experiencing problems with DFB in the following areas: clamp imprints at the neck and the front shirt tail; body creases; and poorly pressed box pleats on the back of the shirt. A man's dress shirt with a pressed-in crease across the shoulders is illustrated.

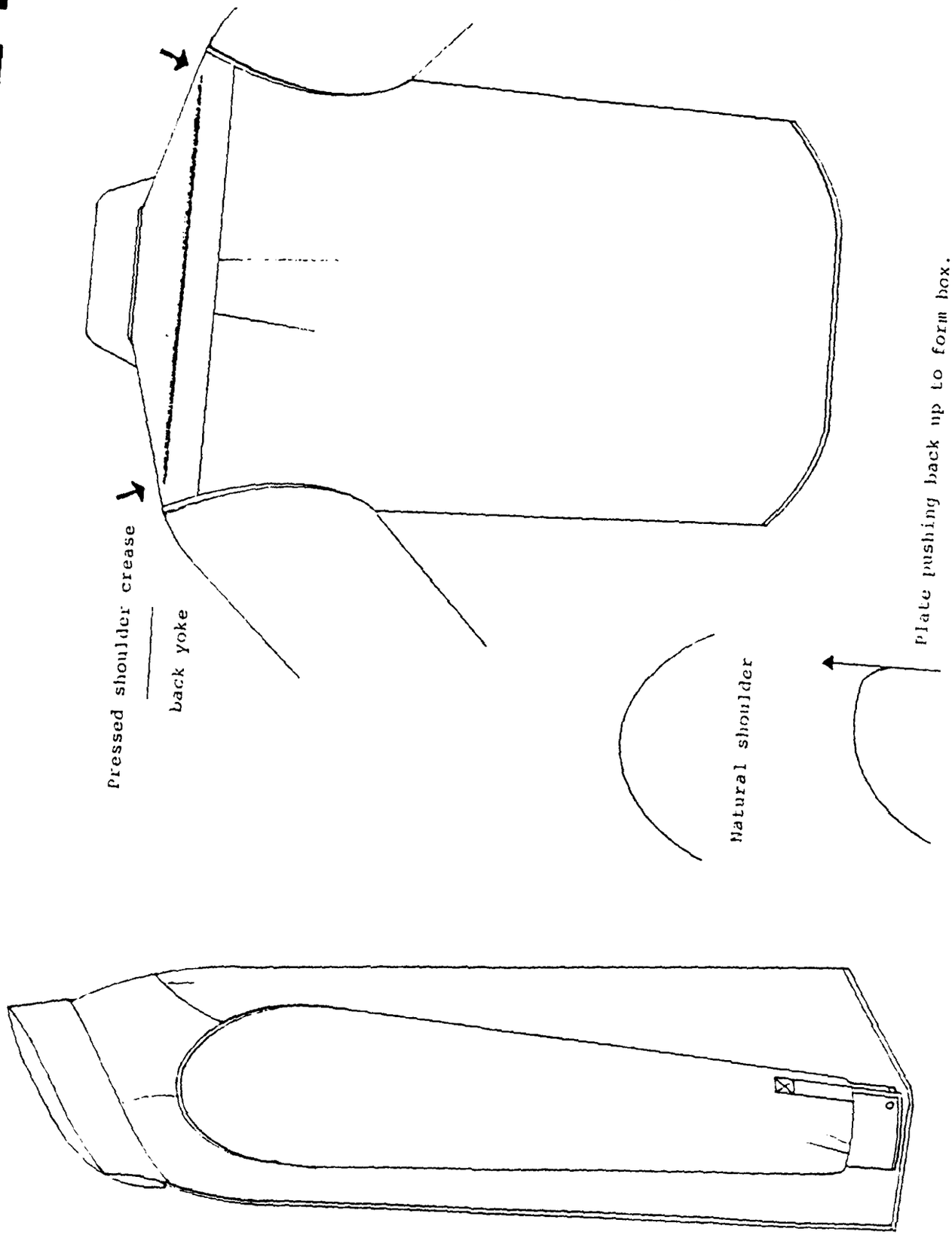
In January, 1990 we observed the press in production and noted that some possible causes for the poor quality of pressing could be insufficient padding, lack of securing the box pleat for pressing, and poor plate shape.

The decision was made to observe the alternative technology of the Kannegiesser Twin Star Press which operates on the same basic principle as the DFB; the operator is responsible for loading and unloading the bucks (although the Kannegiesser has an optional unloader) and initiation of the pressing sequence. The shirt is held on the buck with a clamp at the neck and an internal vacuum. The buck is padded with six layers of different materials, which differs from the DFB cladding. The shoulders of the buck are more rounded in shape, allowing the yoke and the back of the shirt to fall in a more natural manner. The Ajax buck is flatter and pushes the yoke and back of the shirt up and forward. The Twin Star's oil filled pressing plates are contoured to the shape of the bucks.

It was our opinion that the existing DFB technology could be improved to satisfy Garland's manufacturing requirements by making some modifications to the plates, bucks, clamps, and paddings.

> Installation of a clamp on the back of the buck to hold the box pleat. It should be made of spring steel and measure approximately 4" wide by 18" long. It would be secured to the bottom of the buck. The operator would have no problem securing the pleat under the clamp since the spring steel would move easily. In addition, the air bags at the shoulders could be removed and the shoulders could be padded to create a more rounded contour, allowing the yoke to fall across the shoulder and down the back instead of being pushed up and forward.

MEN'S DRESS SHIRT



The front lower clamp should be padded or eliminated. The bucks might be padded with the layers of wool padding similar to the padding on the Kannegiesser Twin Star.

The neck on the press plate and form should be redesigned. (We subsequently learned that American Laundry had agreed to provide Garland with a set of plates that do, in fact, change the configuration of the neck.)

The noted modifications were expected to prevent imprints on a pressed shirt from the collar and front tail clamp; to get a proper pressing of the box pleat on the back of the shirt; and to achieve a flat press on the body.

American Laundry Company modified the Ajax Press by beveling the curve of the neck on the press plate, thereby permitting a better fit when the plate closed. This modification helped to reduce the imprint on the neck but did not completely eliminate it.

The Kannegeisser Shirt Press which was also designed for the same function does not exhibit any problems with clamp imprints or proper pressing of the back pleat. (See Figure 1) It does, however, cost more than twice as much as the Ajax Press. The focus of our comparison was to ascertain if any of the technology used on the Kannegeisser could be adapted to the Ajax Press. Compared to the Ajax Press' two layers of padding, the Kannegeisser press uses six layers. The layer which seemed to make a difference was the silada. It was thought that it provided the necessary cushioning to eliminate the imprints.

The Kannegeisser was observed in a production situation in Dothan, AL. in the same plant as some Ajax Presses. The Ajax Presses were on a progressive bundle line, while the Kannegeissers were on Gerber Garment Mover (unit production system) lines because they can handle size changes without the need to change the bucks since they are equipped with side seam expanders.

In this plant the Ajax Presses had been modified with a spring steel clamp on the back of the buck to secure the box pleat, disconnection of the air bags on the shoulders, extensive use of duct tape to smooth the shoulders and neck to assist in loading, and an additional layer of wool padding.

In an effort to interest American Laundry Company (ALC) in reviewing these modifications arrangements were made to meet with several ALC executives to explain the problems encountered at the Garland Shirt Company.

Previous to the introduction of permanent press garments ALC had a separate division that catered to the apparel industry. The technology that they employed in their apparel division presses sounded very similar to the technology employed in the Kannegeisser press. To their knowledge ALC presses were no longer in use in the apparel industry. As far as they were concerned their primary market was industrial laundries as it was their opinion that shirt manufacturing had left this country and equipment was just being swapped around.

The ALC peopole seemed interested in the possibility of a new market for their press, understanding that certain modifications would be necessary. It was also discovered that the European market (laundry and apparel) had not accepted the press in the past due to the tail clamp imprints. Therefore, if they resolved the imprint problem there would be additional new markets for the press.

Discussions of modifications to the press included: adding a rear tail clamp made from spring steel (as discovered in Phase II), changing the padding on the buck to give more contour, and removing the air bags on the shoulders. In order to correct the imprints from the front tail clamp it would be necessary to investigate several options; redesign the clamp, change the padding, or design a vacuum for the buck.

In addition to the aforementioned modifications, revalving the air bags on the sides of the bucks so that they don't completely open until the plates have gripped the fabric was suggested. (This should prevent the diagonal creasing of the box pleat.) First, the bags would be inflated at a low pressure (.25 psi); after the plates closed the air bags would be filled to 1.5 psi, creating a high pressure that would prevent any creases under the arm in the shirt. This modification to the air pressure cycle would be controlled by needle valves at the air cylinders. It was also noted that these adjustments must be made after the machine had been cycling several times and was "hot", otherwise it would be difficult to properly set the pressures to the air bags, and the quality press required would not be achieved.

There was discussion on how to achieve the proper heat necessary to remove creases from dry material. It was noted that the steam press or the use of thermal fluid would be one way to solve this problem. Thermal fluid run through the steam press might be ideal as there is low risk of cold spots and it would save energy. In some installations it would also eliminate the need for a licensed boiler technician as the thermal fluid is low pressure. Converting an electric press (which Garland has) to steam, however, is questionable. Extensive changes would be necessary and it might not be economical.

The ALC people noted that after the new plates were installed on the press at Garland the shirt was being cut at the neck. They hadn't been able to understand the cause of this problem since, to the best of their knowledge, the plates had been properly set according to their specifications. On viewing a videotape of the press in production a problem with the operator's method of loading the shirts was immediately noted. ALC engineers felt that if the loading method was corrected to incorporate their recommendations there wouldn't be such a severe imprint problem.

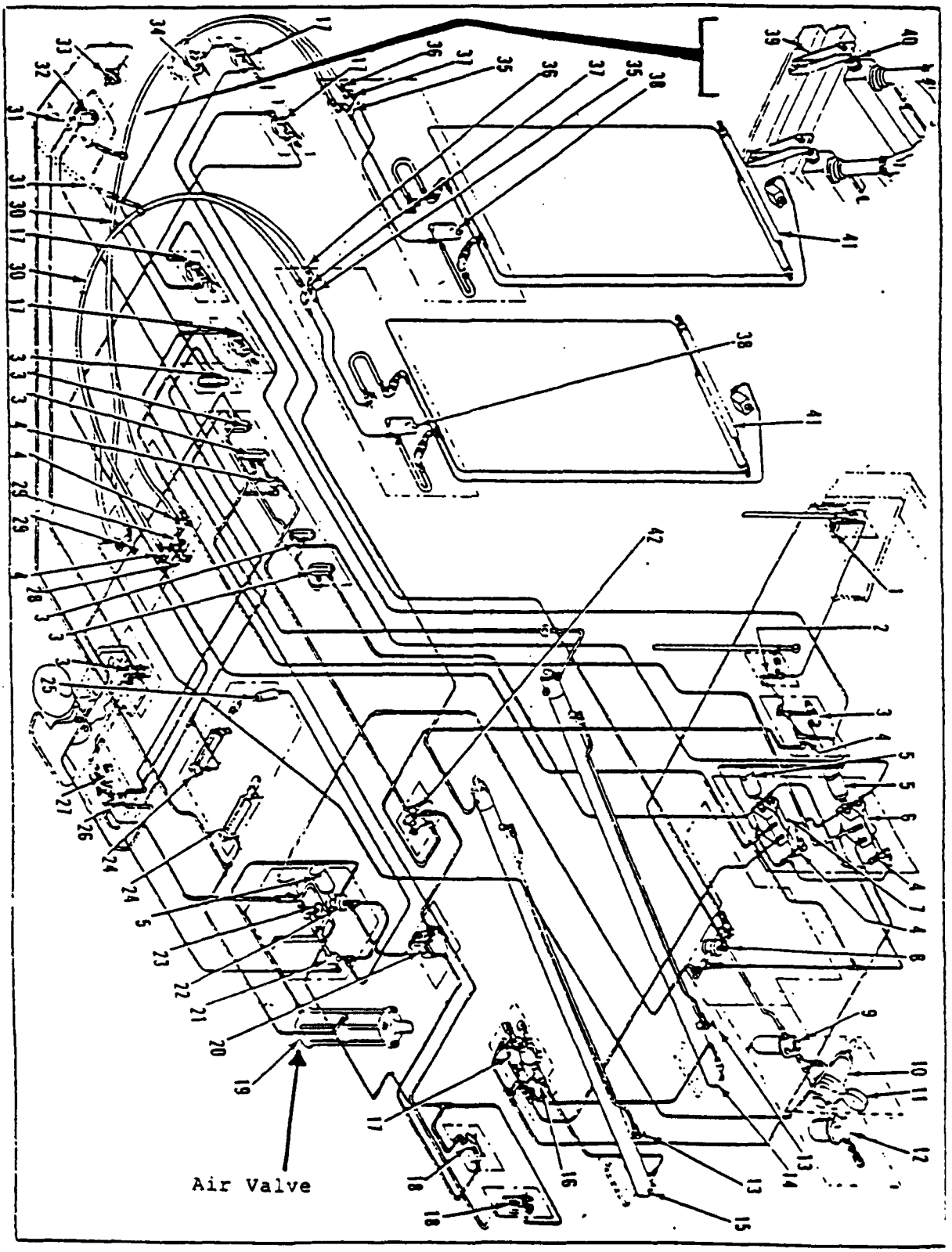
Throughout the meeting there was a sense that perhaps there wasn't proper communication between the field technicians and the home office.

Although invited, American Laundry ultimately declined to actively participate in this project. We therefore proceeded with the implementation of the necessary modifications without ALC assistance.

We made another visit to Garland's plant in Garland, N.C., to determine if the press had a needle valve to control the air pressure into the air bags and to explain that by revalving the pressure to the air bags they would inflate in two steps, thereby allowing the plates to close before the bags opened to full pressure. This would prevent the box pleat from being distorted. Unfortunately, the press did not have this needle valve, so a call was made to the design engineer at American Laundry to confirm the proper location for installation of the valve. He suggested removing air cylinder 25 (See Air System illustration which follows) to test if the initial air pressure was too quick. If the valve wasn't there, then a needle valve should be installed reasonably close to cylinder 19 (19 signals 24 to release the air). The type of needle valve recommended for Garland's use was an adjustable one capable of getting a small air flow. Garland's mechanic was informed of the adjustments to be made to the press and was going to implement the changes.

AIR SYSTEMS

KDFB



KDFB Air System

The pressing supervisor at Garland was made aware the loading method recommended by American Laundry which had been tried but didn't work due to different collar sizes. He said their method gives the best results with the least amount of creasing. He also stated that when the ALC field service technician adjusted the plates so that the curve in the plate met the neck piece, it cut the fabric.

It was becoming evident that there was a discrepancy between American Laundry's engineering methods and the realities of production. There was concern that the solutions to the quality problems were not as simple as ALC suggested and that information wasn't being passed from the field representatives to the ALC engineering department and vice versa.

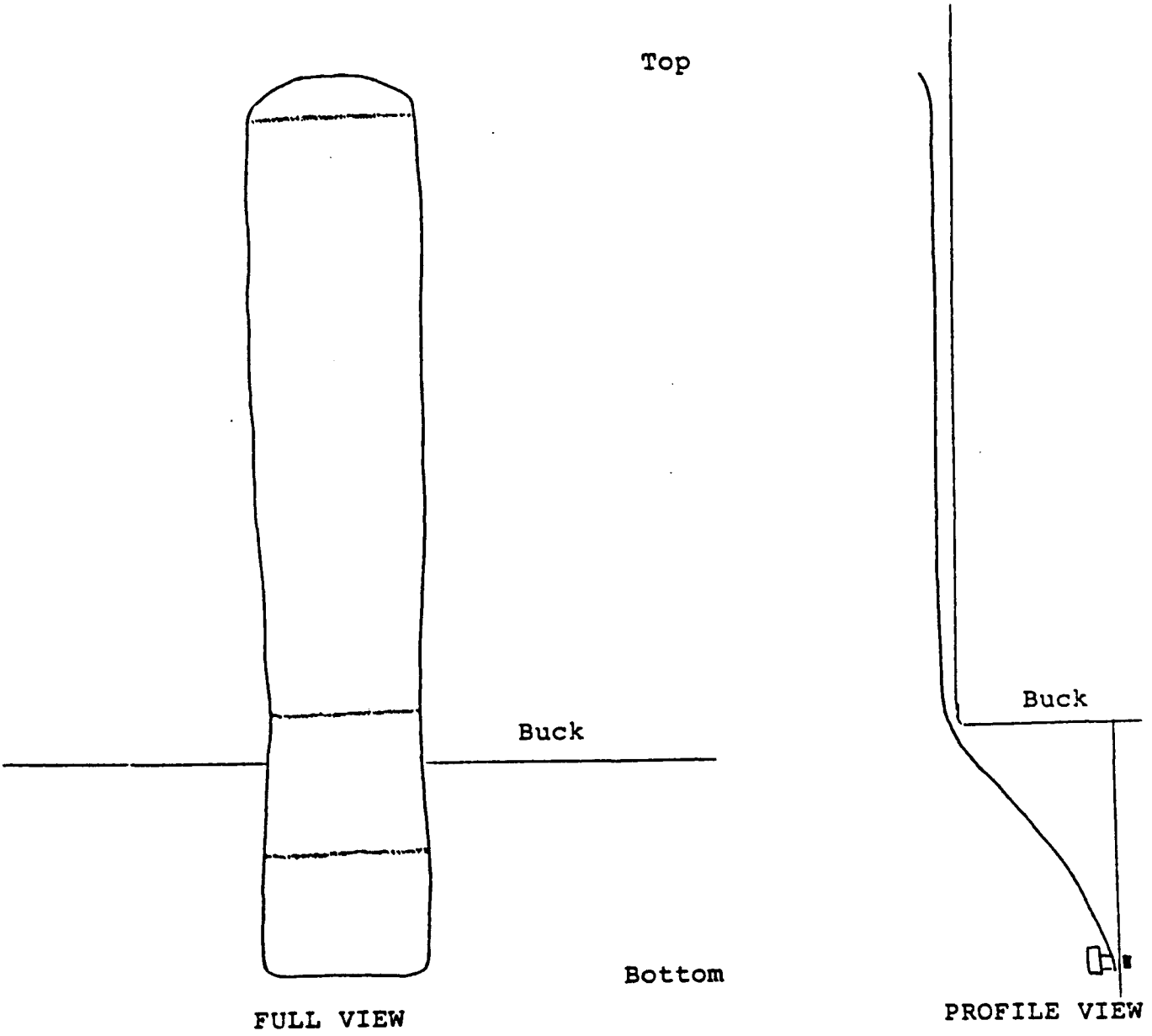
The new plates were observed in operation. In place of one sharp crease, there were now two less distinct creases. Garland was pleased with the improvement. At a later date an adjustment to the air pressure for the bags on the buck was made. This adjustment achieved the desired result and the addition of a needle valve appeared to be unnecessary. Previously, the air bags inflated prior to the plates closing. The change in the valve caused the air bags to inflate after the plates closed. This resulted in a better press of the box pleat.

Other modifications that were made included the addition of a 1.5" X 16" mounting clamp for the back tail clamp made of spring steel, as illustrated, which was installed on the press, and the replacement of the wool padding with a layer of silada.

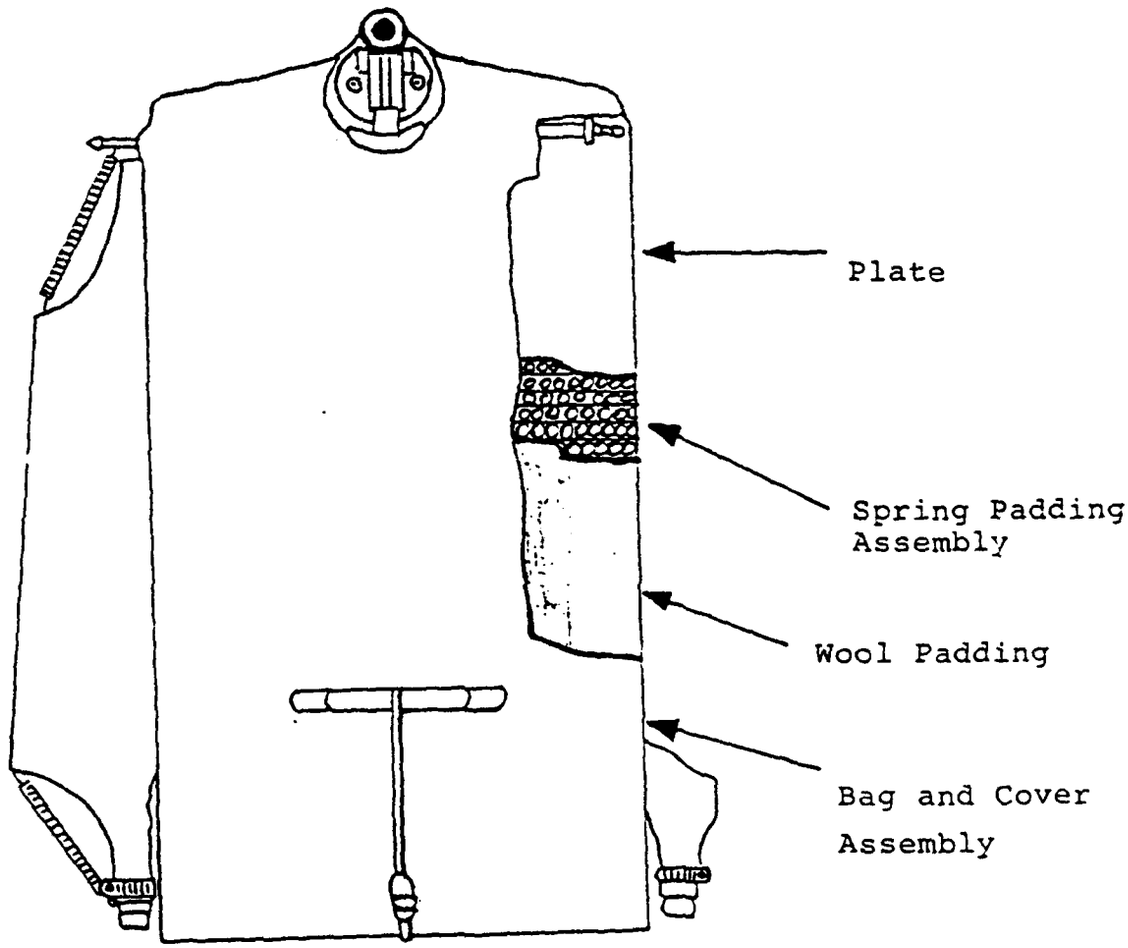
For the latter modification the buck was undressed by removing the cover and wool padding, the wool padding was replaced with 3/8" silada and the buck was recovered (as illustrated).

BACK TAIL CLAMP ASSEMBLY

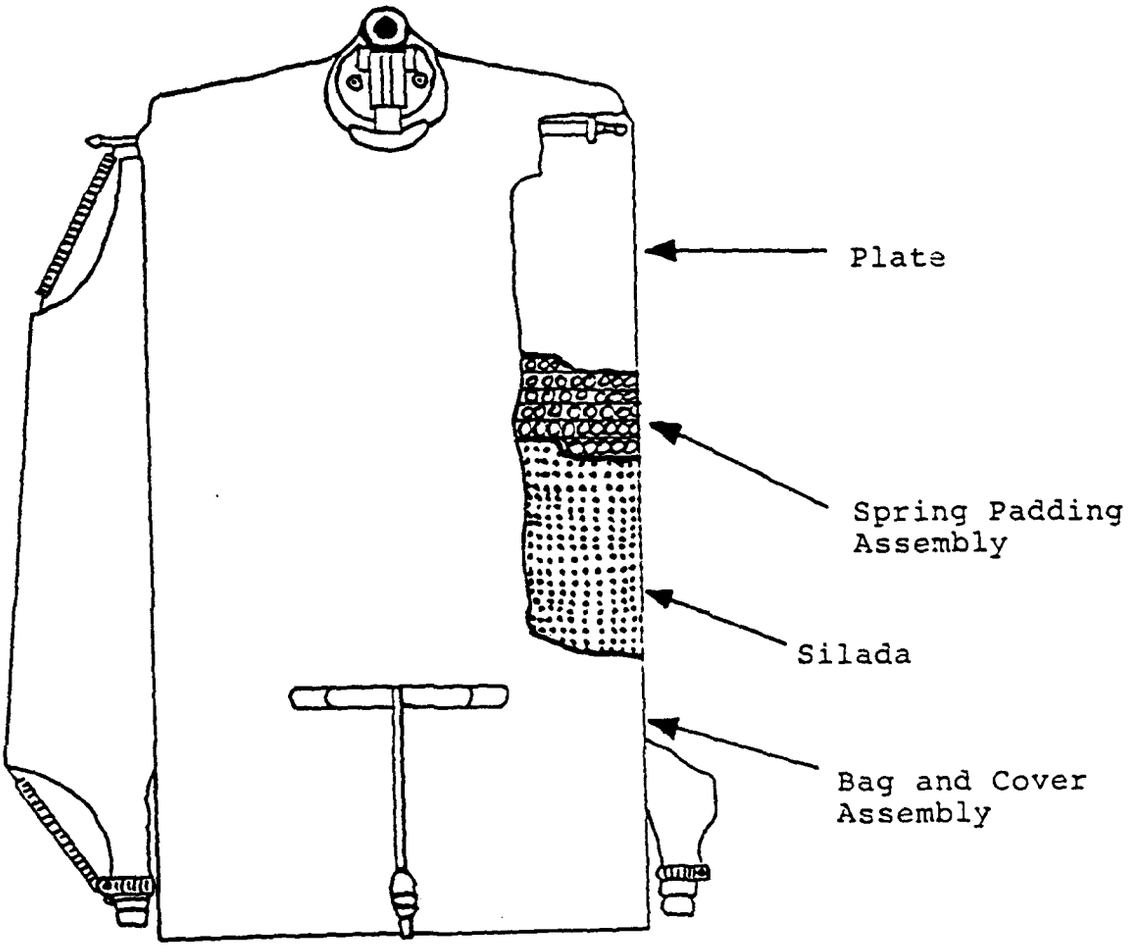
BACK TAIL CLAMP



PADDING CROSS SECTION
AJAX CABINET SHIRT PRESS



MODIFIED PADDING CROSS SECTION
AJAX CABINET SHIRT PRESS



Immediately into testing there was an unforeseen problem: the additional thickness of the silada prohibited the air bags on the buck from inflating. It was therefore necessary to reduce the plate pressure in order for the air bags to inflate but by doing this we lost the proper pressing of the shirt (body wrinkles remained). It was not possible to achieve a proper pressing and air bag inflation. In addition, the heat was not passing through the silada to the outside of the covering and the shirt on the buck. Had it been possible to achieve the balance of plate pressure and air bag inflation it appeared that the silada would have reduced the clamp imprint from the front tail clamp. It did not appear that there would be much of a reduction in the imprint from the collar clamp and this was the most important imprint to remove.

The next area of concentration was testing the effectiveness of the back tail clamp. The silada padding was removed and the buck redressed with the wool padding and cover. At this point the need for a rear view mirror for operator viewing of the back of the buck became evident. This would enable her to properly load the tail clamp. There was a marked improvement in the pressing of the box pleat with the tail clamp but at the same time a loading problem was encountered. Due to the small size of the shirts in these tests and the shape of the shirt tail, which is cut in a deep U shape, the long tail did not drop easily into the clamp.

The final phase of testing dealt with evaluating two different sized clamps and working with an operator to see what kind of results could be achieved. A second tail clamp, measuring 2" X 12", was mounted on the second buck of the Ajax Press. During the testing, the operator had more trouble loading the 1.5" X 16" clamp and achieving a smooth press of the shirt tail. The tension was loosened on the clamp in an attempt to facilitate loading but resulted in insufficient tension to hold the tail and the finished pressing was the same as without a clamp. The shirts pressed during this test period were larger sizes than the shirts pressed in the previous testing and the results were not as good. At best, the improvement was marginal.

SUMMARY

Most of the recommended modifications met with success: the addition of a back tail clamp does result in the proper pressing of the box pleat, and the air valve adjustment works as does the beveled collar. Unfortunately, it is not possible to modify the padding on the Ajax Cabinet Shirt Press without redesigning the technology for achieving a proper press.

The basic cabinet shirt press technology has been available for over 25 years but the only domestic supplier of these presses has left improvements solely to the users. The supplier abandoned the apparel market as it was perceived that that market did not justify continued engineering support and product modifications. All product changes have been directed at the industrial laundry market which is a wet-to-dry pressing process with different requirements than the apparel market's dry-to-dry pressing.

Foreign competitors, however, have taken a more global perspective in marketing and have been developing new systems and improving older ones. Companies such as Kannegeisser, Macpi, Vaporpress and others have recently introduced new equipment, or have updated existing models indicating that there is a market for this technology and that the market should not be narrowly defined as only domestic apparel manufacturers with facilities in tne continguous 48 states.

PROJECT SUMMARY

FACILITATING CHANGE

Prior to 1981, the United States was always the leader when it came to technology. But since then something happened to cause American business to lose its competitive edge.

As a result of our work on Senior Project: Analysis and Improvement of Existing Apparel Technology, we uncovered three problems American business is experiencing when introducing new technology. They are:

- GOOD EQUIPMENT, WRONG APPLICATION
- GOOD EQUIPMENT, POOR METHODS
- EQUIPMENT NEEDS UPDATING

We suspect that these three problems are the root causes of American business' loss of competitive strength.

Prior to purchasing new equipment, a comprehensive feasibility study (see Appendix) should be conducted to determine the suitability of the equipment. We have found that most often this is not done, or if it is the study does not cover all aspects that need to be considered or it overemphasizes the financial criteria without consideration of other pertinent business factors.

COMMUNICATIONS

The importance of communication cannot be over-stressed. Communication between salespeople in the field and the home offices needs strengthening. It appears that the information going back and forth is missing its mark; this line is such an essential link to the successful use of technology that it is vital that the information being transmitted be crystal clear. Better training of field salespeople is one important way that this channel could be opened; ethics is another. There are a number of highly ethical vendors who won't sell their products if they know that the applications are wrong. By demanding a performance guarantee, manufacturers could insure a high level of sales ethics from vendors and avoid unnecessary purchases of the wrong equipment.

In addition to clear communications, continuous learning is necessary for the achievement of good work methods. This is one of the vital responsibilities of managers as well as supervisors, operators and mechanics.

TRADE SHOWS AND SEMINARS

Trade shows are an excellent place for managers, et al, to continue their learning experiences. Trade shows should feature more shared knowledge seminars in place of consultant sales sessions/seminars. We've seen significant increases in positive responses from seminar participants when they had the opportunity to question other people facing the same or similar situations or problems. There is a real need to redirect the sessions: the apparel manufacturers should do the speaking and the equipment vendors should do the listening. It is time for the seminars to become market driven. There are numerous trade associations (see Exhibit 1) that could sponsor seminars either independently or in conjunction with a conveniently located educational institution. The current sales driven system is outdated and it is driving American manufacturers out of business.

In addition to trade show seminars, members of management should visit other plants and exchange information. Manufacturers need to understand that not everyone is out to steal their business and that an exchange of information could be mutually beneficial.

Special local seminars should be sponsored to encourage a broader base of participants, especially aimed at the smaller military contractors. Examples of these are the Defense Personnel Support Center's Quality Conference which has been held in the past at the Fashion Institute of Technology (F.I.T.), and the special seminar on supervision for Brooks Brothers' supervisors, also held at F.I.T.

TRAINING

There are a number of ways by which managements can continuously train their staffs. Interactive videos (see Exhibit 2) are an excellent method for training mechanics as well as operators. There are also video training tapes (see Exhibit 3) available from trade associations and research groups for group and self instruction of supervisors. Trainers can be brought in to teach

supervisors to supervise as well as to teach operators. The establishment of periodic quality control audits would reveal the use of good or poor training methods and enable managements to make corrections if necessary.

There is a need for the establishment of a supervisor certification program. With the need for and the introduction of high technology into the workplace, training of supervisors should take place in an educational environment, one in which they can be taught the essentials of high technology in an atmosphere that is conducive to learning. Too often their on-the-job training is condensed, rushed, or foreshortened so that they can return to their production jobs sooner. The common complaint heard from mechanics is that supervisors and operators are not given enough time to properly learn the machines and develop an understanding of the logic behind how they work. The mechanics feel that if supervisors and operators are given more training time on the machines they would be more productive and the mechanics would not have to troubleshoot minor adjustments that could be handled by either the operators or the supervisors.

VENDOR FOLLOW UP

One important area which should not be overlooked is vendor follow up after the sale. Once the equipment is installed the vendor should make it part of his/her business to follow up on the methods being used to operate the equipment. Since it is an acknowledged fact that we retain only 70% of what we learn, it is reasonable to assume that it takes repeated training to perfect a proper method of use. It follows then that with an industry facing record levels of labor turnover, follow up becomes very critical.

PARTNERSHIPS

Vendors and manufacturers would greatly benefit from the establishment of "partnerships" for the purpose of sharing information. Manufacturers know what their needs from equipment are but too often vendors design equipment without the knowledge of manufacturers' needs. The result is equipment that doesn't quite fit the bill. Also, vendors should advise their customers of any equipment updates; and they should consider designing upgrade kits instead of new equipment only.

RESEARCH AND DEVELOPMENT

There is a need for consortiums to develop new equipment. They exist in the European Community where small manufacturers have banded together for the purpose of research and development (R&D), often supported by government funding. The Japanese Ministry of International Trade & Industry (MITI) supports research and development conducted by private companies such as Juki, etc. Researchers at Sweden's Chalmers University developed FIGARMA, a system for Fully Integrated Garment Manufacturing. This system enables technology designed for large scale operations to be changed so that it can be more easily integrated into smaller scale operations.[17]

The average American apparel industry plant has 200 - 300 employees and a diverse product base. The suppliers of these average plants are also diverse and small. They lack the resources to develop technology, such as computer integrated manufacturing (CIM), without government assistance. This problem has been recognized and a research center has been set up at the University of Southwestern Louisiana in cooperation with the American Apparel Manufacturers Association (AAMA). This center is now in its infant stage of working with CIM.

There is a need for the establishment of industry research centers and the sharing of research between industries. The problem of carpel tunnel syndrome exemplifies this need. It is a problem that exists in a number of different industries and the duplication of research efforts going on in them is an unnecessary waste of dollars. To foster more efficient use of R&D monies trade associations could establish Research Action Committees to promote the funding of research and development of technology. Associations and suppliers could jointly contribute funds to be matched by appropriate government agencies and these funds would then be utilized to sponsor research projects at designated research centers. The Department of Commerce's program at TC^2 could serve as a model for matching fund efforts: the industry comes up with a sum of money, and the government matches it.

Government research efforts should be two pronged: short term application; and long term experimental. American research dollars need to be spent more wisely. At present, only a small percent is spent on refining manufacturing techniques, while nearly 70% is spent on developing new products. Japan spends nearly two-thirds of its research and development dollars on

manufacturing processes, "figuring out how to make a zillion widgets cheaper or better."[18] Dollarwise, American non-military research and development spending greatly exceeds that of all other countries. However, as a percentage of Gross National Product (GNP), the United States spends only 1.7% of its GNP on R&D, compared to West Germany, which spends 2.6% of their GNP, and Japan which spends 2.8% of their GNP.

We recognize that American industry invests at a low level in research and development and in new plant and equipment, but massive expenditures will not necessarily yield better results. Unless we learn how to make better use of our investments we will not achieve the desired goals of production availability and lower cost of finished products. It is hoped that the model and guidelines developed in this study will assist military and civilian apparel manufacturers in creating successful strategies for incorporating technology in their operations.

FEASIBILITY MODEL

This model should be applied to the making of any decision that could cause change in an organization. If more firms followed these steps then the introduction of technology into organizations would have a higher rate of success.

STEPS TO SUCCESS

Step 1 Identify objectives which should be clear, concise, able to be objectively measured, and which are endorsed by top management.

Step 2 Research using the feasibility study guidelines and checklist (Appendix A) to complete thorough technical, economic, environmental, and operational analyses.

Step 3 Develop alternatives to accomplish objectives based on the data collected utilizing the feasibility study guidelines.

Step 4 Select an alternative to be implemented and establish a master plan of execution.

Step 5 Inform all personnel who will be affected regarding the complete nature of the changes prior to their implementation.

Step 6 Training personnel as required. i.e. mechanics, supervisors, operators depending on the type of technology being introduced.

Step 7 Installation and set up should be a joint venture between the vendor and the manufacturer as detailed in the feasibility study and governed by the contracts.

Step 8 Test phase. Here we try the system to prove that it can perform the task. This is a joint effort of the vendor and manufacturer.

Step 9 Modification phase. Adjust the master plan developed in Step 4 with the information developed during the test phase in Step 8.

Step 10 Implementation. Run the new technology or system in real time.

Step 11 Continuous review. Once a technology or system has been implemented it should be continuously scrutinized and updated. This process ensures that as the business environment changes the technologies and systems evolve with it and continue to operate in harmony with the objectives identified in Step 1.

Step 12 Return to Step 1 and repeat the sequence on a continuous basis as required by Step 11.

FOOTNOTES

1. Apparel Industry Magazine, March 1987, "Nothing But the Best", Linda J. Mallin

2. Bobbin, April 1989, "Hemingway's Wau Wins New Business", Susan L. Smarr

3. Apparel Industry Magazine, November 1985, "Crafted with Style", Karen Schaffner

4. Bobbin, May 1989, "Manufacturers Embrace Medium Technology", Bud Marshall

5. DNR, September 17, 1986, "Automation Just as Valuable to Smaller Manufacturers", Brenda Lloyd

6. Apparel Industry Magazine, December 1987, "Cal Sport", PK

7. Apparel Industry Magazine, November 1985, "Crafted with Style", Karen Schaffner

8. Apparel Manufacturer, January 1990, "To Replace or not to Replace?", Mark E. Battersby

9. Bobbin, April 1989, "Hemingway's Way Wins New Business", Susan L. Smarr

10. California Apparel News, November 29, 1985, "Computer-Controlled Equipment Essential", Leslie Bayor

11. Apparel Industry Magazine, November 1988, "Real Time Advances"

12. WWD/DNR Supplement, August 30, 1990, "Fred Shippee Speaks His Mind", Jim Ostroff

13. Bobbin, September 1986, "TC Squared - Apparel, Textile and Education at its Best"

14. Bobbin, May 1989,"Manufacturers Embrace Medium Technology", Bud Marshall

15. Apparel Industry Magazine, March 1987, "Nothing but the Best", Linda J. Mallin

16. Bobbin, May 1989, "Manufacturers Embrace Medium Technology", Bud Marshall

17. DNR, January 13, 1986, "Japan Developing Robots to Make Apparel Parts"

18. Fortune, November 6, 1989, "America's Place in World Competition", Brian O'Reilly.

APPENDIX

FEASIBILITY STUDY AND CHECKLIST

FEASIBILITY STUDY

INTRODUCTION

The objective of a feasibility study is to provide the best solution to a problem. During the process clear objectives have to be set and agreed to by top management, data has to be collected, alternatives developed, and a course of action agreed upon and implemented.

With a technology problem this procedure can become an overwhelming exercise of research, financial analysis, and paperwork. As one proceeds through this maze it is extremely easy to skip over key facts which could easily lead to good equipment or systems being ordered for the wrong application, or good proposals never being adopted.

We have reviewed traditional paybacks, non-traditional paybacks, cost worksheets, and we have interviewed vendors and users to develop a comprehensive checklist. We have combined all of the needed data points into one report to cut down on paperwork and duplicate work efforts.

The objective of the checklist is to present general data and cost figures for a proposal in one standardized format. The company can then use either the payback analysis, return on investment, internal rate of return, or net present value approach to see if the project satisfies the company's return requirements. We have also identified supplemental questions the answers to which should accompany the cost figures so that anyone analyzing the worth of a project may also have adequate background information to make a quality, informed judgement.

PREPARING THE REPORT OVERVIEW

The text portion of the study should include the following:

1. A general description of the project under consideration.

This will include:

a. A summary of fiscal allocations.
b. A description of the methods used in researching and evaluating the project.
c. An analysis of "What happens if you're wrong?"
d. A discussion of the criteria to be used to measure success or failure of the project and how these criteria were established.

2. Project resource and foundation information. This section will identify the atmosphere under which the idea was conceived. This should include:

a. Marketing factors, such as changes in sales demand, costs, quality, competitor activity, consumer attitudes, etc.
b. Technical factors, such as the need to improve the performance of the end product, productivity, quality of any phase of the manufacturing process, etc.
c. The obsolescence of current equipment and the impact thereof, such as downtime, spare parts, mechanic overtime, operations efficiency, etc.

This section will also include the alternatives that were considered and which influenced the course of action selected. It will cover such topics as:

* What if the project is not approved?
* Alternate routes available for achieving the same or similar results.
* Why this is the best method picked.

3. Economic assumptions. This section will include:

a. A discussion of the key economic assumptions that were made.
b. Identification of the assumptions that are the most critical for the success of this project.
c. A listing and discussion of the assumptions for which you have the least confidence and the most.

4. Project summary. This section will include:

   a. A statement of the objective of the project.
   b. An analysis of the project's costs.
   c. A discussion of the purpose of the project, covering such topics as environment, business development, market drive, price, volume, growth, etc.
   d. An examination of the timing of the project. Is the start up or finish time significant to its success? Discuss the impact of the "window of opportunity".
   e. A discussion of the technical factors required for success.
   f. An analysis of the adequacy of capital requested.
   g. An appraisal of the impact of the project on business strategy.
   h. An analysis of the financial impact of the project on the company.

CHECKLIST FOR EVALUATING EQUIPMENT AND SYSTEMS

NOTE: THE FOLLOWING CHECKLIST IS NOT FOR COMPUTER AND SOFTWARE ANALYSIS.

THE CONSIDERATION TO PURCHASE EQUIPMENT OR SYSTEMS SHOULD BE BASED ON MEASURABLE CRITERIA:

CAN WE INCREASE PRODUCTIVITY?

CAN WE COMBINE OPERATIONS TO REDUCE LABOR?

CAN WE DESKILL THE JOB?

CAN WE MATCH OR IMPROVE QUALITY?

WILL WE BE ABLE TO MEET OR EXCEED CONSUMER EXPECTATIONS OF OUR PRODUCT?

CAN THE PRECEDING OBJECTIVES ONLY BE ACHIEVED WITH THE NEW EQUIPMENT OR SYSTEM?

THE OBJECTIVE OF THE FOLLOWING CHECKLIST IS TO GUIDE THE SMALL TO MEDIUM APPAREL MANUFACTURER IN THE MAKING OF CAPITAL INVESTMENT DECISIONS.

A. GENERAL DATA	CURRENT	PROPOSED
1. NAME OF EQUIPMENT:	_____	_____
2. MODEL NUMBER:	_____	_____
3. VENDOR:	_____	_____
4. VENDOR'S ADDRESS:	_____	_____
	_____	_____
5. VENDOR'S TELEPHONE #:	_____	_____
6. SALESMAN:	_____	_____
7. CUSTOMER SERVICE/ ENGINEERING CONTACT:	_____	_____
	_____	_____

8. Do either of the current or proposed methods yield excess capacity which can be utilized by other manufacturers or contractors tc generate revenue for our company?

	CURRENT	PROPOSED
	Yes_____ No_____	Yes_____ No_____
If yes, annual dollar value.	$_____	$_____

B. INTEREST RATES

1. Current rate on 3 month treasury bill. _____%

2. Current rate on 12 month treasury bill. _____%
(You may also consider using the company's cost of capital here.)

3. Company requirement for return on investment. _____%

C. OPERATION DESCRIPTION

General method descriptions. How is the operation performed?

CURRENT	PROPOSED

D. QUALITY SPECIFICATIONS

Attach the appropriate quality specifications including a full description of expected quality standards for the operation. Note any impact on other operations.

Include machine specifications for normal operation including current and proposed methods.
Machine Specifications:

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF
EXISTING APPAREL TECHNOLOGY

	CURRENT	PROPOSED
1. Operation RPM:		
2. Stitches per inch: (if applicable)		
3. Thread specifications:		
Needle		
Bobbin		
Looper		
4. Attachments:		
5. Table type:		

6. Layout Description (Fill in dimensions on drawings)

CURRENT	PROPOSED

E. SERVICE

1. Does the vendor supply a warranty on:

		CURRENT		PROPOSED	
a.	Labor	Yes _____	No _____	Yes _____	No _____
	If yes,	30 days____	60 days____	30 days_____	60 days____
		90 days____	Other_____	90 days_____	Other_____
b.	Parts	Yes _____	No _____	Yes _____	No _____
	If yes,	30 days____	60 days____	30 days_____	60 days_____
		90 days____	Other_____	90 days_____	Other_____

	Yes	No	Yes	No
2. Does the vendor provide update information:	_____	_____	_____	_____
If yes, how.				
a. Salesperson's visits	_____	_____	_____	_____
b. Direct Mail	_____	_____	_____	_____
c. Other (Specify)	_____	_____	_____	_____
Are performance guarantees available from vendor?	_____	_____	_____	_____

Note: This should be included in your purchase order.

F. UTILITY REQUIREMENTS

	CURRENT			PROPOSED		
	Yes	No		Yes	No	
1. Steam	_____	_____		_____	_____	
-Boiler horse power			_____BHP			_____BHP
-Operating pressure.			_____PSI			_____PSI

2. Electric	____	____		____	____		
-Voltage Phase			_____VOLTS			_____VOLTS	
-Phase.			_____PHASE			_____PHASE	
-Amps.			_____AMPS			_____AMPS	
3. Air	____	____		____	____		
-Cubic foot per min.			_____CFM			_____CFM	
-Operating pressure.			_____PSI			_____PSI	
4. Vacuum	____	____		____	____		
-Horsepower.			_____HP			_____HP	
5. Water	____	____		____	____		
-Cubic feet per min.			_____CFM			_____CFM	

G. PURCHASE/LEASE/RENT/TRIAL

The following options may be available. The option most suitable should be selected based on your company's individual needs.

1. Purchase Option

	CURRENT	PROPOSED
a. Cost of purchase:	$_____	$_____

b. Specify terms of payment.

_____

_____

_____

_____

_____

_____

c. Specify total yearly payment.

	CURRENT	PROPOSED
YEAR 0 (Year 0 for security deposit)	$_____	$_____
YEAR 1	$_____	$_____
YEAR 2	$_____	$_____
YEAR 3	$_____	$_____
YEAR 4	$_____	$_____
YEAR 5	$_____	$_____

2. Lease Option

	CURRENT	PROPOSED
a. Is lease option available?	Yes_____ No_____	Yes_____ No_____

b. If yes, specify type of lease (Check which is/are applicable).

1. Financial Lease	*1	_____	_____
2. Operating Lease	*2	_____	_____
3. Sale & Leaseback	*3	_____	_____
4. Other		_____	_____

Definitions:

Lease: A lease is a long term agreement for the rental of capital equipment or any other asset.
Lessor: The owner of any asset offered for lease in return for periodic payments.
Lessee: The user of an asset offered by a lessor for use under conditions specified in the lease contract.

*1 Financial Leases: This is an irrevocable contract between the lessor and the lessee who is legally bound to continue payments for the duration of the lease. The lessor agrees to maintain the equipment for the lease duration and lessor usually regains ownership of the capital equipment at the end of the period.

*2 Operating Lease: Also known as a maintenance lease, this lease type allows for the termination of the lease agreement before the end of the contract under conditions detailed in the agreement. The lessor is responsible for the maintenance of the equipment.

*3 Sale & Leaseback: In this lease type the owner of the equipment sells the specific asset and leases it back for internal use, affording the owner use of capital which would have otherwise been tied up in the asset.

Note: The preceding lease definitions are generalizations and are not necessarily adhered to by any leasing firm. Each leasing organization is responsible for the details of their individual leases. Details of each available lease type including agreement details should be appended.

c. Highlight major differences between the available lease types including variance in costs.

_____

_____

_____

_____

_____

_____

_____

_____

d. Specify total yearly payment amount. If there is a buy-out option (closed-end lease), then place that figure in the year following the last lease payment.

	CURRENT	PROPOSED
YEAR 0 (Year 0 for security deposit)	$_____	$_____
YEAR 1	$_____	$_____
YEAR 2	$_____	$_____
YEAR 3	$_____	$_____
YEAR 4	$_____	$_____
YEAR 5	$_____	$_____
YEAR 6	$_____	$_____

e. Interest rate for the lease: _____% _____%

3. Loan Option

	CURRENT	PROPOSED
a. Total dollar amount of loan:	$_____	$_____
b. Number of payments:	_____	_____
Dollar amount of each:	$_____	$_____

c. Specify total yearly payment.

	CURRENT	PROPOSED
YEAR 0 (Year 0 for security deposit)	$_____	$_____
YEAR 1	$_____	$_____
YEAR 2	$_____	$_____
YEAR 3	$_____	$_____
YEAR 4	$_____	$_____
YEAR 5	$_____	$_____

d. Interest rate :	_____%	_____%
Adjustable rate:	Yes_____No_____	Yes_____No_____
	1yr_____3yr_____	1yr_____3yr_____
	Other_____	Other_____
	Fixed_____	Fixed_____
e. Prepayment Penalty:	Yes ____ No____	Yes_____No_____

If yes, state conditions:

_____

_____

_____

_____

_____

4. Loaner Equipment

a. Is loaner equipment available?	Yes____ No_____	Yes_____ No_____
b. Cost of loaner:	$_____	$_____
c. Time restriction on loaner?	Yes_____ No____	Yes_____ No_____

What conditions apply to loaner equipment?

_____

_____

_____

_____

_____

5. Rental Option

	CURRENT	PROPOSED
a. Time period of rental.	_____	_____
b. Specify total yearly payment.		
YEAR 0 (Year 0 for security deposit)	$_____	$_____
YEAR 1	$_____	$_____
YEAR 2	$_____	$_____
YEAR 3	$_____	$_____
YEAR 4	$_____	$_____
YEAR 5	$_____	$_____

6. Trial Option

a. Terms _____

_____

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF
EXISTING APPAREL TECHNOLOGY

b. Possible Costs

	Current		Proposed	
	Yes	No	Yes	No
1. Freight	_____	_____	_____	_____
2. Technical support	_____	_____	_____	_____
3. Packaging	_____	_____	_____	_____
4. Unpacking	_____	_____	_____	_____
5. Training	_____	_____	_____	_____
6. Hotel expenses	_____	_____	_____	_____
7. Food	_____	_____	_____	_____
8. Travel	_____	_____	_____	_____
9. Auto rental	_____	_____	_____	_____
10. Installation of utilities	_____	_____	_____	_____
11. Carpeting	_____	_____	_____	_____
12. Plumbing	_____	_____	_____	_____
13. Other _____	_____	_____	_____	_____
_____				
_____				

	CURRENT	PROPOSED
YEAR 0 (Year 0 indicates installation costs)	$_____	$_____
YEAR 1 (Year 1 includes decommissioning and returning of trial equipment)	$_____	$_____

H. SALES REVENUES

1. Estimated sale price per unit for the product in the following years.*

	CURRENT	PROPOSED
Year 1	$_____	$_____
Year 2	$_____	$_____
Year 3	$_____	$_____
Year 4	$_____	$_____
Year 5	$_____	$_____

2. Estimated unit sales.

	CURRENT	PROPOSED
Year 1	_____	_____
Year 2	_____	_____
Year 3	_____	_____
Year 4	_____	_____
Year 5	_____	_____

* Note: If this purchase will affect multiple products, then weighted averages should be used.

3. Revenue

	Current (H1 x H2)	Proposed (H1 x H2)
Year 1	_____	_____
Year 2	_____	_____
Year 3	_____	_____
Year 4	_____	_____
Year 5	_____	_____

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF
EXISTING APPAREL TECHNOLOGY

I. SQUARE FOOTAGE REQUIREMENTS

	CURRENT	PROPOSED
1. Equipment floor space	_____sq. ft.	_____sq.ft.
2. Service area	_____sq.ft.	_____sq.ft.
3. Annual overhead factor per square foot:	$_____	$_____
4. Annual cost for this space:	_____ (I1 + I2) x I3	_____ (I1 x I2) x I3

J. MAINTENANCE CONTRACT

	CURRENT	PROPOSED
1. Does the vendor offer maintenance contracts?	Yes____ No____	Yes____ No____

If yes, state the annual cost and add the contract as an addendum to this study.

$_____ $_____

2. Service visits by vendor.

	Yes	No	Yes	No
a. No charge	____	____	____	____
b. Transportation only	____	____	____	____
c. Full charge time/expense	____	____	____	____
d. Other (Specify)	____	____	____	____

Specify other _____ _____

_____ _____

e. Are high mortality parts kits available? ____ ____ ____ ____

f. Kit Cost* $_____ $_____

* Note: Complete listing of parts should be included .

g. Normal parts use (annual): $_____ $_____

K. TRAINING REQUIREMENTS

CURRENT	PROPOSED
1. Mechanics Yes_____ No_____	1. Mechanics Yes_____ No_____
If yes, On-site_____ Vendor_____	If yes, On-site_____Vendor_____
No. of days required _____	No. of days required _____
Cost,if any $_____	Cost, if any $_____
2. Supervisors Yes_____ No_____	2. Supervisors Yes_____ No_____
If yes, On-site_____ Vendor_____	If yes, On-site_____ Vendor_____
No. of days required _____	No. of days required _____
Cost,if any $_____	Cost, if any $_____
3. Operators Yes_____ No_____	3. Operators Yes_____ No_____
If yes, On-site_____ Vendor_____	If yes, On-site_____ Vendor_____
No. of days required _____	No. of days required _____
Cost,if any $_____	Cost, if any $_____
4. Management Yes_____ No_____	4. Management Yes _____ No _____
If yes, On-site_____ Vendor_____	If yes, On-site_____ Vendor _____
No. of days required _____	No. of days required _____
Cost,if any $_____	Cost, if any $_____
5. Are there any special pay programs for compensation for training time?	
Yes_____ No_____	Yes_____ No_____
a. Estimated annual cost $_____	a. Estimated annual cost $_____
b. Special start-up costs $_____	b. Special start-up costs $_____

If yes, (current or proposed) attach a full explanation of training program to be implemented including criteria for success.

6. Are there any special training aids available from the vendor?

Yes_____ No_____ Yes_____ No_____

If yes, indicate type and cost.

	CURRENT			PROPOSED		
	Yes	No	Cost	Yes	No	Cost
a. Interactive video	_____	_____	$ _____	_____	_____	$_____
b. VHS video	_____	_____	$ _____	_____	_____	$_____
c. Films	_____	_____	$ _____	_____	_____	$_____
d. Self study workbooks	_____	_____	$ _____	_____	_____	$_____
e. Other	_____	_____	$ _____	_____	_____	$_____

7. What other languages are owners manuals available in?

	CURRENT		PROPOSED	
	Yes	No	Yes	No
Spanish	_____	_____	_____	_____
French	_____	_____	_____	_____
Chinese	_____	_____	_____	_____
Other	_____	_____	_____	_____

L. ENVIRONMENTAL REQUIREMENTS

	CURRENT			PROPOSED		
	YES	NO	COST	YES	NO	COST
1. Air Conditioning	____	____	a. Set-Up $_____	1. ____	____	a. Set-Up $_____
			b. Annual $_____			b. Annual $_____
If yes, BTU requirement			_____BTU			_____BTU
2. Heating requirements	____	____	a. Set-Up $_____	2. ____	____	a. Set-Up $_____
			b. Annual $_____			b. Annual $_____
If yes, BTU/hr required			_____BTU/hr			_____BTU/hr
3. Humidifier/Dehumidifier	____	____	a. Set-Up $_____	3. ____	____	a. Set-Up $_____
			b. Annual $_____			b. Annual $_____
4. Explosion proof room	____	____	a. Set-Up $_____	4. ____	____	a. Set-Up $_____
5. Special safety enclosures, guides, or other OSHA requirements.	____	____	Set-Up $_____	5. ____	____	Set-Up $_____
6. Special lighting	____	____	a. Set-Up $_____ b. Operating Cost $_____	6. ____	____	a. Set-Up $_____ b. Operating Cost $_____

If yes, describe type_____

_____

_____

Reason:_____

_____

_____

If yes, describe type_____

_____

_____

Reason:_____

_____

_____

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF
EXISTING APPAREL TECHNOLOGY

7. Are there any special clothing requirements?

CURRENT	PROPOSED
Yes____ No ____	Yes____ No____
If yes, describe type._____	If yes, describe type._____
_____	_____
Reason:_____	Reason:_____
_____	_____
_____	_____
8. Is the clothing employer___or employee___provided?	8. Is clothing employer____or employee____provided?
If employer provided:	If employer provided:
a. Number of units necessary annually _____	a. Number of unit necessary annually _____
b. Purchase price (per unit) $_____	b. Purchase price (per unit) $_____
Annual Purchases $(a x b) $_____	Annual Purchases $(a x b) $_____
Uniform rental Yes____ No___	Uniform Rental Yes____ No____
c. Unit cost per year $_____	c. Unit cost per year $_____
Annual rental $(a x c) $_____	Annual rent $(a x c) $_____
9. Fire suppression system Yes____ No___	9. Fire suppression system Yes____ No____
If yes, describe type._____	If yes, describe type._____
_____	_____
_____	_____
Cost $_____	Cost $_____

10. Estimate annual maintenance of special services listed in items 1-9:

Cost $_____

10. Estimate annual maintenance costs of special services listed in 1-9:

Cost $_____

M. INSTALLATION

1. Who is responsible for the set-up of new equipment? In house _____ Vendor _____ Other_____

2. Estimated time for installation: _____

3. Cost: a) Labor $_____
b) Materials $_____

4. Is rigging required? Yes_____ No_____

If yes, Cost $ _____

5. Are any building modifications necessary? Yes_____ No_____

Cost $_____

If yes, describe modifications necessary.

_____

_____

_____

_____

_____

6. Disposal cost for removal of current system. $_____

7. Revenue from sale of current system. $_____

8. Are permits required? Yes _____ No_____

If yes, permit type:

_____

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF
EXISTING APPAREL TECHNOLOGY

Granting Authority:

---

a) One time installation fee: $ _____

b) Annual Fee: $ _____

9. Was a vendor survey performed to confirm that the proper item is being purchased, to accomplish the specified task? Yes _____ No _____

If yes, name of vendor salesperson. _____

Date survey completed _____

(Additional recommendations or changes should be specified in a formal report by vendor.)

10. Are there any other companies using this equipment? Yes _____ No _____

If yes, Company Name

---

11. Does your company require a first visit to another company currently using the equipment before acquisition of new equipment. Yes _____ No _____

If yes, indicate who will participate.

Inspection Cost $_____

12. Are there any templates, retooling, custom attachments etc. that must be developed initially? Yes _____ No _____

If yes, give a full explanation of method of conversion.

_____

_____

_____

_____

Conversion cost $_____

13. Are there any templates, retooling, custom attachments that must be developed with changing styles?

CURRENT	PROPOSED
Yes_____ No _____	Yes____ No_____

If yes, give a full explanation of method of conversion.

_____

_____

_____

a. Estimated number of conversions per year. _____ __	a. Estimated number of conversions per year _____
b. Cost per conversion $ _____ ____	b. Cost per conversion $_____
Annual cost (a x b) $ _____	Annual cost (a x b) $_____

14. If we adopt this procedure will it impact any other operation that precedes or follows. Yes ____ No____

If yes fully explain the nature of the changes and cost.

_____

_____

_____

a. Installation Costs: $_____

b. Annual Costs: $_____

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF
EXISTING APPAREL TECHNOLOGY

N. DIRECT LABOR COST ANALYSIS

	CURRENT	PROPOSED
1. Standard allowed minutes/unit	a)_____	a)_____
2. Weighted average base rate per hour divided by 60	a)$_____	a)$_____
3. Workers compensation premiums and claims as a percentage of payroll	a)_____%	a)_____%
b)Multiply (2a) x (3a)	b)$_____	b)$_____
4. Excess cost as a % of base earned pay. (Include overtime, make-up, delays	a)_____%	a)_____%
b) Multiply (2a) x (4a)	b)$_____	b)$_____
5. Fringe benefits as a % of total labor.	a)_____%	a)_____%
b) Multiply (2a) x (5a)	b)$_____	b)$_____
6. Overhead factor applied to labor.	a)$_____	a)$_____
b) Multiply (2a) x (6a)	b)$_____	b)$_____
7. Total labor cost per unit Multiply (1a) X (2a+3b+4b+5b+6b)	a)_____	a)_____

8. Annual labor cost:

	CURRENT Multiply (7a) x (H2)	PROPOSED Multiply (7a) x (H2)
Year 1	_____	_____
Year 2	_____	_____
Year 3	_____	_____
Year 4	_____	_____
Year 5	_____	_____

O. INDIRECT LABOR COST ANALYSIS

1. Are any new jobs going to be created with the implementation of this new equipment?

Yes _____ No _____

1b. If yes, describe new job(s).

_____

_____

_____

_____

1. Are any new jobs going to be deleted with the implementation of this new equipment?

Yes _____ No _____

2. If yes, describe deleted job(s).

_____

_____

_____

	CURRENT	PROPOSED
3. Indirect labor costs.	a)$_____	a)$_____
4. Overtime costs as % of Indirect labor payroll.	a)_____%	a)_____%
b) Multiply (3a) x (4a)	b)$_____	b)$_____
5. Fringe Benefits as a % of indirect labor payroll.	a)_____%	a)_____%
b) Multiply (3a) x (5a)	b)$_____	b)$_____

	CURRENT	PROPOSED
6. Overhead factor applied to indirect labor payroll.	a)$_____	a)$_____
b) Multiply (3a) x (6a)	b)$_____	b)$_____
7. Total annual indirect labor. Add 3a+4b+5b+6b	a)$_____	a)$_____

P. MATERIAL COST ANALYSIS

1. a) Material cost per unit (Direct & Indirect) _____ _____

b) Annual material cost.

	CURRENT (Multiply H2 x P1a)	PROPOSED (Multiply H2 x O1a)
Year 1	_____	_____
Year 2	_____	_____
Year 3	_____	_____
Year 4	_____	_____
Year 5	_____	_____

Q. QUALITY RELATED COST ANALYSIS

	CURRENT	PROPOSED
1. Average annual labor cost of repair and reinspection for product(s) affected by this decision.	$_____	$_____ _____
2. Average annual costs of scrapped product(s).	$_____	$_____
3. Annual net costs of product(s) that are not first quality (i.e. seconds). This should include manufacturing costs minus any revenues received for it.	$_____	$_____

4. Annual excess due to repairs, scrapped & seconds. Include process delays. $_____ $_____

R. WASTE REMOVAL COST ANALYSIS

1. Type of waste generated.(Check where appropriate.)

	CURRENT	PROPOSED
a. Liquid	_____	_____
b. Sewer	_____	_____
c. Solid	_____	_____
d. Hazardous	_____	_____
e. Recyclable	_____	_____
f. Initial construction debris	_____	_____

2. Annual cost of waste removal a)$_____ a)$_____

S. WORK IN PROCESS INVENTORY FINANCING COST ANALYSIS

1. Total number of units of work-in-process. a)_____ a)_____

2. Direct labor cost per unit. a)_____ a)_____
(Insert N7a here) (Insert N7a here)

3. Material cost per unit. a)_____ a)_____
(Insert P1a here) (Insert P1a here)

4. a) Annual cost of quality. a)_____ a)_____
(Insert Q5a here) (Insert Q5a here)

b) Cost of quality per unit.

	CURRENT (Divide S4a by H2)	PROPOSED (Divide S4a by H2)
Year 1	_____	_____
Year 2	_____	_____
Year 3	_____	_____
Year 4	_____	_____
Year 5	_____	_____

5. a) Annual cost of waste removal

a)_____ (Insert R2a here)

b)_____ (Insert R2a here)

b) Cost of waste removal per unit

	CURRENT (Divide S5a by H2)	PROPOSED (Divide S5a by H2)
Year 1	_____	_____
Year 2	_____	_____
Year 3	_____	_____
Year 4	_____	_____
Year 5	_____	_____

6. Value per unit

a)_____ (Add S2+S3b+S4+S5b and insert here)

a)_____ (Add S2+S3b+S4+S5b and insert here)

7. Throughput time in days

a)_____

a)_____

8. Financial cost for work in process
Formula:
(S1a) x (S6a) x (S7a) x (B2) =

a)_____

a)_____

T. DEPRECIATION

1. The firm's tax rate on profits: a)_____

2. The true purchase price is derived by adding the purchase price + installation cost + initial training required to commission the equipment (or system) being purchased. We will then use the straight line method for depreciation in generating the credit

$$\frac{\text{Purchase Price} - \text{Residual Value}}{\text{Useful Life of the Asset in Units}}$$

Residual value: An estimate of the scrap value at the end of the period designated as useful life.

Useful life units: Depending on the type of asset they may be measured in years, miles, hours of operation, units of production completed.

a. To calculate the full purchase price as indicated in step 2, we shall use the proposed data. Fill in the numbers from the checklist in the designated space, add across for subtotals, then total the results.

G1a	K1	K2	K3	K4	K5b	K6a	K6b	K6c	K6d	K6e	Subtotal
L1a	L2a	L3a	L4a	L5a	L6a	L9	M3a	M3b	M4	M5	Subtotal
M6	M8a	M11	M12	M14a							Subtotal

Revised purchase price:$_____

b. The Internal Revenue Service has published a table of acceptable time periods for the useful life of various types of assets. Consult them, your accountant or local professional accounting society for an up to date listing to cover the project being evaluated.

c. Sample calculation to determine the annual cash flow savings:

Assumptions:

1. At the end of the useful life the asset has no value.
2. Useful life is 5 years, tax rate 33%, purchase price as calculated above is $480,000.

$$\frac{\$480{,}000 - 0}{5 \text{ years}} = \$96{,}000 \text{ depreciation per year} \times .33 \text{ (tax rate)} = \$32{,}000$$

d. If this investment was depreciable, then you would insert the number calculated in c above into the Summary Chart for Revenues and Expenses under Revenues (Cash Inflows) in A.4.1.

A.4 SUMMARY CHART OF REVENUES AND EXPENSES

(For proper analysis complete two worksheets; first for current method, second for proposed method.)

A.4.1. REVENUES (CASH INFLOWS)

		Year: 1	2	3	4	5
-From outside source	(A8)					
-From depreciation	(T2c)					
-From sales	(H3)					
-From sale of assets	(M7)					
TOTAL REVENUES:						

INSTALLATION DOWNPAYMENT

A.4.2. EXPENSES (CASH OUTFLOWS)

			1	2	3	4	5
-Purchase	(G1c)	(G1c)					
-Lease	(G2d)	(G2d)					
-Loan	(G3c)	(G3c)					
-Rental	(G5b)	(G5b)					
-Trial	(G6b)	(G6b)					

-Square footage overhead (I4) _____ _____ _____ _____ _____

1 2 3 4 5

-Maintenance (J1) _____ _____ _____ _____ _____

-Parts (J2f)_____ (J2g) _____ _____ _____ _____ _____

-Training (K1) _____

(K2) _____

(K3) _____

(K4) _____

(K5b)_____ (K5a) _____ _____ _____ _____ _____

-Training Aids (K6a)_____

(K6b) _____

(K6c) _____

(K6d) _____

(K6e) _____

-Environmental (L1a) _____ (L1b) _____ _____ _____ _____ _____

(L2a)_____ (L2b) _____ _____ _____ _____ _____

(L3a)_____ (L3b) _____ _____ _____ _____ _____

(L4) _____

(L5) _____ (L6b) _____ _____ _____ _____ _____

(L6a)_____ (L8b) _____ _____ _____ _____ _____

SENIOR PROJECT:
ANALYSIS AND IMPROVEMENT OF
EXISTING APPAREL TECHNOLOGY

			1	2	3	4	5
-Uniforms/special clothing		(L8c)					
-Fire Suppression	(L9)						
-Maintenance Cat. L Items		(L10)					
-Installation	(M3a)						
	(M3b)						
	(M4)						
	(M5)						
	(M6)						
	(M8a)	(M8b)					
	(M11)						
	(M12)	(M13b)					
	(M14a)	(M14b)					
-Direct Labor		(N8)					
-Indirect Labor		(O7)					
-Materials		(P1b)					
-Quality		(Q1)					
		(Q2)					
		(Q3)					
		(Q4)					

			1	2	3	4	5
-Inventory		(S8)	_____	_____	_____	_____	_____
-Waste Removal	(R1f)_____	(R2)	_____	_____	_____	_____	_____
TOTAL EXPENSES:	_____		_____	_____	_____	_____	_____
NET CASH FLOW:	<_____>*		_____	_____	_____	_____	_____

*Will always be negative for installation expenses as revenue will be $0.

NET PRESENT VALUE NOTE:

If your firm uses net present value on cash flows, do not lump totals. Analyze year by year as a flat sum and discount back to year 1. Most firms would use the firm's acceptable project return, noted in B.3., for the interest rate to be used in this analysis.

EXHIBIT 1: TRADE ASSOCIATIONS

Affiliated Dress Manufacturers
1440 Broadway
New York, NY 10018
(212) 398-9797
Alex S. Redein, Executive Director

Allied Underwear Association
100 East 42 Street
New York, NY 10017
(212) 867-5720
Jacob P. Rosenbaum, Executive Director

Amalgamated Clothing and Textile Workers Union
15 Union Square West
New York, NY 10003
(212) 242-0700
Jack Sheinkman, President

American Apparel Contractors Association
10 Maryeanna Drive
Atlanta, GA 30342
(404) 843-3171
R. Donald Strickland, CEO

American Apparel Manufacturers Association (AAMA)
2500 Wilson Boulevard, Suite 301
Arlington, VA 22201
(703) 524-1864
G. Stewart Boswell, President
Divisions: Swimwear Industry Manufacturers (SWIM)
Southern Garment Manufacturers Association (SGMA)

American Cloak and Suit Manufacturers Association
450 Seventh Avenue
New York, NY 10123
(212) 244-7300
Peter Conticelli, Executive Director

American Fiber, Textile, Apparel Coalition (AFTAC)
1801 K Street, N.W., Suite 900
Washington, DC 20006
(202) 862-0500
Charles V. Bremer, Executive Vice President

American Textile Machinery Association (ATMA)
7297 Lee Highway, Unit N
Falls Church, VA 22042
(703) 533-9251
Harry W. Buzzerd Jr., Executive Vice President

American Textile Manufacturers Institute (ATMI)
1801 K. Street, N.W., Suite 900
Washington, DC 20006
(202) 862-0500
Charles V. Bremer, Executive Vice President

Apparel Guild
147 West 33 Street, Suite 407
New York, NY 10001
(212) 279-4580
Leon Newman, Executive Officer

Associated Corset and Brassiere Manufacturers
475 Fifth Avenue, Suite 1908
New York, NY 10017
(212) 532-6960
Jack Glauberman, Executive Director

Association of Rain Apparel Contractors
225 West 39 Street
New York, NY 10018
(212) 819-1011
Arnold R. Harris, Executive Director

Atlantic Apparel Contractors Association
P.O. Box 639
Wind Gap, PA 18091-0639
(215) 863-9061

Boys and Young Mens Apparel Manufacturers Association
240 Madison Avenue
New York, NY 10016
(212) 686-3440
Jack Carver, Executive Officer

Career Apparel Institute
1156 Avenue of Americas
New York, NY 10036
(212) 869-0670
Albert Vogel, President

ChildrensWear Credit Guild Inc
505 Eighth Avenue
New York, NY
(212) 695-6660

Childrenswear Manufacturer Association
66 East Main Street
Moorestown, NJ 08057
(609) 234-9155
William L. MacMillan III, Executive Director

Clothing Manufacturers Association of the USA (CMA)
1290 Avenue of Americas, Suite 1061
New York, NY 10104
Robert A. Kaplan, Executive Director

Color Association of the US, The
409 West 44 Street
New York, NY 10036
(212) 582-6884
Mavielle Bancov, Executive Director
Margaret Walch, Membership Director

Council of American Fashion
1710 Broadway
New York, NY 10019
(212) 265-7000

Council of Fashion Designers of America
1412 Broadway, Suite 1006
New York, NY 10018
(212) 302-1821
Robert Raymond, Executive Director

Custom Tailors and Designers Association of America
17 East 45 Street
New York, NY 10017
(212) 661-1960
Irma Lipkin, Executive Director

Federation of Apparel Manufacturers (FAM)
225 West 34 Street, Suite 1416
New York, NY 10122
(212) 594-0810
Cory Greenspan, Executive Director

Federation of Retail Merchants (FRM)
185 Great Neck Road, Suite 300
Great Neck, NY 11021
(516) 487-7407

Fiber, Fabric, and Apparel Coalition for Trade (FFACT)
1801 K. Street, N.W., Suite 900
Washington, DC 20006
(202) 862-0517
Daniel K. Frierson, Chairman

French Fashion & Textile Center
200 Madison Avenue, Room 2225
New York, NY 10016
(212) 213-0170
Barbara Ende, Executive Director

Greater Blouse, Skirt, and Undergarment Association
225 West 34 Street
New York, NY 10122
(212) 563-5052
Howard Morris, Executive Director

Hong Kong Trade Development Council
673 Fifth Avenue
New York, NY 10022
(212) 838-8688
The Hon. Baroness Dunn, Chairman
Jack So, Executive Director

Industrial Association of Juvenile Apparel Manufacturers
264 West 35 Street
New York, NY 10001
(212) 244-2953
Alan D. Lubell, President

Infant and Juvenile Manufacturers Association
100 East 42 Street
New York, NY 10017

Infants', Children's and Girls' Sportswear and Coat Association
450 Seventh Avenue
New York, NY 10123
(212) 563-1118
Stanley Halperin, Executive Director

International Association of Clothing Designers
240 Madison Avenue, 12 floor
New York, NY 10016
(212) 685-6602
Norman Karr, Executive Director

International Formalwear Association
111 East Wacker Drive, Suite 600
Chicago, IL 60601
(312) 644-6610
Jack M. Springer, Executive Director

International Ladies Garment Workers Union (ILGWU)
1710 Broadway
New York, NY 10019
Jay Mazur, President

International Mass Retail Association
1901 Pennsylvania Avenue, N.W., Suite 10
Washington, DC 20006
(202) 861-0774

Intimate Apparel Association (IAA)
171 Madison Avenue room 501
New York, NY 10016
(212) 679-0008
George Katz, President

Intimate Apparel Manufacturers Association (IAMA)
475 Fifth Avenue, Suite 1908
New York, NY 10017
(212) 725-5599
Alex J. Glauberman, Executive Director

Italian Trade Commission
499 Park Avenue, 6 floor
New York, NY 10022
(212) 758-1050
Alfonso Barbera, Trade Commissioner
Sandy L. Singer, Trade Analyst

Juvenile Products Manufacturers Association
2 Greentree Center, Room 225
Marlton, NJ 08053
(609) 985-2878
William L. MacMillan

Ladies Apparel Contractors Association
450 Seventh Avenue
New York, NY 10001
(212) 564-6161
Sidney Reiff, Executive Director

Men's Apparel Club of New York City
2057 Ellen Drive
Merrick, NY 11566
(516) 379-1377
Roslyn Rubin, Executive Director

Men's Apparel Guild of California (MAGIC)
300 South Grand Avenue
Los Angeles, CA 90071
(213) 626-0735

Men's Fashion Association of America
240 Madison Avenue
New York, NY 10016
(212) 683-5665
Norman Karr, Executive Director

Menswear Retailers of America (MRA)
2011 I Street, N.W.
Washington DC 20006
(202) 347-1932
Douglas W. Wiegand, Executive Director

Metropolitan Area Apparel Association
150 Fifth Avenue, Room 407
New York, NY 10011
(212) 243-6425
Jack Barnes, Executive Director

Millinery Information Bureau (MIB)
302 West 12 Street, Penthouse C
New York, NY 10014
(212) 627-8333
V. Casey Bush, Executive Director

National Association of Blouse Manufacturers
450 Seventh Avenue, Room 2304
New York, NY 10123
(212) 563-6390
Steven E. Thomas, Executive Director

National Association of Fashion and Accessory Designers
2180 East 93 Street
Cleveland, Oh 44106
Beatrice Spencer, President

National Association of Hosiery Manufacturers (NAHM)
447 South Sharon Amity Road
Charlotte, NC 28211
(704) 365-0913
Sid Smith, President

National Association of Milliners, Dressmakers, and Tailors
157 West 126 Street
New York, NY 10027
(212) 666-1320
Alma Gross, President

National Association of Uniform Manufacturers and Distributors
(NAUMD)
1156 Avenue of the Americas
New York, NY 10036
(212) 869-0670
Bernard J. Lepper, Executive Director

National Knitwear Manufacturers Association (NKMA)
365 South Street
Morristown, NJ 07960
(201) 326-1650
Robert E. Blanchard, President

National Knitwear and Sportswear Association (NKSA)
386 Park Avenue South
New York, NY 10016
(212) 683-7520
Seth M. Bodner, Executive Director

National Outerwear and Sportswear Association (NOSA)
240 Madison Avenue
New York, NY 10016
(212) 686-3440
Jack Carver, Executive Officer

National Retail Merchants
100 West 31 Street
New York, NY 10001
(212) 244-8780

Neckwear Association of America
151 Lexington Avenue
New York, NY 10016
(212) 683-8454
Gerald Anderson, Executive Director

New York Coat and Suit Association
225 West 39 Street
New York, NY 10018
(212) 398-2888
Arnold Harris, Executive Director

New York Skirt and Sportswear Association
225 West 34 Street, Room 1406
New York, NY 10122
(212) 564-0040
Alan Rosenberg, President
Eli Elias, Executive Director

New York State Infants & Children's Wear Association
13550 South West Sixth Court
Apt. 307A
Pembrokes Pines, FL 33027
(305) 432-8031
Samuel Cohn, Secretary/Treasurer

Southeastern Apparel Manufacturers and Suppliers (SEAMS)
1900 Broad River Road
Columbia, SC 29210

Sundries and Apparel Findings Council (SAFLINC)
8757 Red Oak Boulevard
Charlotte, NC 28217
(704) 523-1000
Carl Yount, Chairman

Textile Apparel Linkage Council (TALC)
P.O. Box 3725
Greenville, SC 29608
(803) 242-6300
Thomas Mitchell, Chairman

Underfashion Club
295 Fifth Avenue, Room 621
New York, NY 10016
(212)481-7792
Harriet Levenson, President

United Better Dress Manufacturers Association
110 West 40 Street
New York, NY 10018
(212) 354-7042
John Infantolino, Executive Director

United Infants' and Children's Wear Association
1328 Broadway, Room 814
New York, NY 10001
(212) 244-2953

Voluntary Interindustry Communications Standards Committee (VICS)
3100 West Big Beaver Road
Troy, MI 48084
(313) 643-5042
J.R. Thomas, Chairman

Young Menswear Association
1328 Broadway
New York, NY 10001
(212) 594-6422
Theodore M. Kaufman, Secretary

EXHIBIT 2: INTERACTIVE VIDEOS

Union Special

HF600 Machine Troubleshooting
63400 Mechanic Training
39500 Operator & Mechanic Training

Brother

DB2-B737-413 Introductory Operator & Mechanic Training
E-100 Panel Introductory Operator & Mechanic Training

Juki

DDL-5550-6 Introductory Operator & Mechanic Training
SC-120 & SC-220 Panel Introductory Operator & Mechanic Training
SC-320 Panel Introductory Operator & Mechanic Training DDL-5550-6 Advanced Mechanic Training

Generic Courses

Hydraulics
Pneumatics
Electricity
Electronics
Safety
Maintenance
301 Lockstitch
515 & 516 Safety Stitch
401 Chainstitch
504 Overedge Stitch

Other interactive video programs are being developed for future distribution. Special request programs that are privately funded are also produced.

EXHIBIT 3: VIDEO TRAINING PROGRAMS

A modern method of instruction for supervisors is video training courses. It is recognized that it is difficult to arrange time for supervisors to attend seminars or special schools, so learning tapes have been developed to assist in educating these people on a flexible schedule.

SUPERVISORY TRAINING PROGRAM FOR APPAREL MANUFACTURERS

The purpose of this program is to provide training for first line supervisors in the performance of their required job functions in the light of new and emerging advanced apparel manufacturing technologies. It was developed by the Fashion Institute of Technology's Advanced Apparel Manufacturing Technology Demonstration Center in New York City under the auspices of the Defense Logistics Agency, Cameron Station, Alexandria, VA.

The programs were developed in response to the sewing industry's need to take advantage of new and emerging advanced equipment and technologies. They are the result of research conducted throughout the member companies of the industry and reflect what management felt to be information most needed by supervisors. The areas covered in these programs include:

Worker Orientation
Human Relations Aspects of Supervision
Praise and Criticism of Performance
Employee Grievances
Introduction to New Equipment
Quality
Orientation to Industrial Engineering Concepts
Balancing
Getting the Work Out Through Lot Control

Five programs focus on the human relations side of the supervisor's job:

Worker orientation - how to get new employees off on the right foot;

The human relations aspects of supervision - how to be a model supervisor;

How to constructively praise and criticize an employee;

How to effectively deal with complaints and grievances; and,

How to introduce the worker to new technology.

Four other programs deal with the production side of supervision:

Producing quality work;

Understanding how engineering concepts apply to the manufacturing scene;

Balancing the production schedule; and,

Getting the work out through lot control.

While each of these programs stands on its own and can be viewed separately, the last two programs - balancing and lot control - are linked to each other.

There is a separate, introductory program designed specifically for review by members of management.

PROGRAM SUMMARIES

The following are brief summaries of the basic instructional points that each of the programs contain.

THE ORIENTATION OF NEW EMPLOYEES

Since the cost to train and recruit a new employee is high, management has a big financial stake in retaining its recruits. Part of the supervisor's job is to encourage new workers to stay with the company and minimize turnover. Good first impressions are often the key to success and can make the difference between staying and leaving.

Communication is the heart of the supervisor-employee relationship. By using it properly the supervisor can build a basis for winning the trust and confidence of the new worker.

When a new employee has a sense of the overall picture of the environment in which he or she works, how different departments interact, the key personnel the employee should know about, and his or her fellow workers, he/she develops a sense of belonging and should be expected to remain with the company longer.

The supervisor is instructed in the best methods to introduce perhaps the most important concept in the new employee's job, quality, by clearly and emphatically defining the quality standards that the company expects.

This segment recognizes that each company has it own way of doing things. However, the important thing is to win the employee's commitment to the plant and the first step on this road begins the moment the new employee's foot crosses the threshold.

HUMAN RELATIONS ASPECTS OF SUPERVISION

In this program segment the model supervisor's behavior is examined. Focus is on a number of different situations in which the supervisor is called upon to solve problems, some of which he or she may not have answers to. When that happens, what should the supervisor do? Answers to that question are offered in this segment.

The importance of the supervisor listening to what's being said when an employee presents a problem is stressed: not just the words, but the intention behind the words, the operator's real concerns.

Strong note is made that the supervisor has to be in touch with what's going on with the employees and must recognize that different workers have different personalities, and that their personalities will affect the way they approach their work.

In today's changing environment, more and more plants are using Flexible Manufacturing Systems - the team approach to high quality production and Quick Response. In this setting the supervisor needs to have different management skills relative to team participation in the decision-making process and encouraging cooperation between its members. Perhaps the most important management skill the modern supervisor needs is flexibility. This program shows how the supervisor can deal with these problems and many others and offers concrete solutions.

PRAISE AND CRITICISM

Many supervisors would say that praising an employee is easy enough. But that is not necessarily the case. When a supervisor praises someone he/she has to be sensitive to the person being praised. Timing is extremely important as is whether or not to praise privately or publicly.

This program also demonstrates the accepted techniques of supervisory criticism so as to effect a positive change in behavior and not have a confrontation. The use of politeness, discretion, timing, listening to the employee's explanation, offering solutions to problems and setting a climate for trust, and most important, not making criticism personal are discussed. At the same time, warnings about the pitfalls of criticism such as losing one's temper or humiliating an employee in public are expressed. The program also deals with how to praise and criticize performance under team work conditions without disrupting the team. Praise and criticism are stressed as being part of the supervisor's most effective management tools when used wisely and with sensitivity.

EMPLOYEE COMPLAINTS AND GRIEVANCES

It is normal and natural for people to complain. This segment emphasizes that it is the supervisor's job to deal with complaints promptly and fairly and prevent them from becoming major grievances. In this way the supervisor maintains a smooth running operation, fosters good company morale, and maintains productivity.

The program talks about how the supervisor must take every complaint seriously and try to get a sense of what the employee is really unhappy about. It is the supervisor's job to resolve complaints, and the key to dealing with them is not to take them personally but to look at them objectively, deal with them directly, and settle them.

Complaints have to be nipped in the bud for the sake of the morale of the work force and the productivity of the plant.

INTRODUCTION OF NEW EQUIPMENT IN THE WORK PLACE

Nothing seems more threatening to people in today's factories than technological change. One of the most difficult challenges that supervisors face is convincing their operators to accept technological change in the work place. In this program ways in which supervisors can prepare workers for change are examined. First, an overview of some of the more recent technological innovations in apparel manufacturing is presented, showing how computer-controlled equipment has revolutionized the sewing industry and altered the traditional ways of doing things. Then, the program shifts to the supervisor's role in introducing this equipment into the work area and getting employees to accept it. Many workers will become anxious about their job security, wages, the obsolescence of their skills, and the need to be retrained. These are legitimate concerns and supervisors have to be prepared to answer them.

The focus of this program is to smooth the way for the introduction of new technology by dealing with these tough issues directly, giving straightforward answers, and putting things in proper perspective for the employees.

DEALING WITH QUALITY ON THE FACTORY FLOOR

Repairs. The supervisor's nightmare and most critical responsibility, insuring the quality of the product. Quality is the basis of the company's reputation. It cannot be inspected into a garment. The garment must be made right in the first place.

While the supervisor is always on the prowl for poor work, he or she is often only as good as the inspection system the company uses. But whatever the system, it is the supervisor's job to see that poor quality work is spotted before it leaves the production area.

This program looks at some of the systems the supervisor uses for controlling quality - and their strengths and weaknesses. Some of these systems include:

> The 100% inspection system in which all the units may be inspected, usually at the end stage of production, with the result that the supervisor may not know where the problem started; and,

The skip interval process in which samples are checked at various intervals in the production process to minimize defects. This program shows how to sample efficiently so as to spot defects early, have them corrected, and returned to the process.

Whatever the system, the supervisor is in the front line in the battle for quality, instilling in the operators the basic philosophy of Make-It-Right-the-First-Time.

ORIENTATION TO INDUSTRIAL ENGINEERING CONCEPTS

To many supervisors the industrial engineer is as welcome in their department as ants at a picnic because they feel that the engineer's main concern is for production, not for the people who make the production possible.

This program shows how the engineer and the supervisor should work together harmoniously for the good of the company, and how important it is for the supervisor to understand the engineer's responsibilities. It talks about how in most sewing factories the engineer spends a good deal of his or her time developing and applying cost and work standards for the various operations in the plant, making plant layouts, designing facilities, planning systems, reviewing costs, examining job standards, and making sure new machine purchases are justified. The program stresses that to carry out many of these responsibilities the engineer needs input from the supervisor. The engineer can be regarded as providing the scientific basis for the supervisor's practical applications.

KEEPING THE UNIT BALANCED

These are many questions that supervisors have to answer as they begin their weekly battle to get the work out - overcoming a sea of obstacles that lie in wait for them. The well-trained supervisor usually works from a weekly plan that allows him or her to match resources with the work schedules. This program shows how the supervisor plans to balance the work load. It shows how to actually balance the operations, determining how many available hours there are and balancing equipment and the number of operators to meet the demands of the schedule. The program includes an introduction to making up a balancing schedule that applies to a real-life situation.

Once the plan is drawn up, the supervisor has to get into the production units and see that it works by getting the work out.

GETTING THE WORK OUT THROUGH LOT CONTROL

Getting the work out. That's what it all comes down to. How to move the cut goods through the network of machines and operators to come up with a finished product. How to deal with emergencies and repairs, rush priorities and unexpected problems - and yet meet the schedules so the company can fulfill its commitments. It's a big job for any supervisor. In this program these problems are dealt with. The program demonstrates how lot control helps the supervisor get the bundles through the manufacturing process in the most efficient manner possible, systematically meeting daily production goals and sticking to production schedules.

The program also discusses certain tools that can help the supervisor get the work out while keeping an eye out for stragglers that can slow up the line and cause delays. Some tools can also help move rush priority work through the system with a minimum of disruption. Some of the tools discussed are short interval balancing work sheets that schedule the hours each operator will spend on a style, and matrix verification plans that enable the supervisor to see at a glance what bundles are being worked on and which have been completed.

The bottom line is that a supervisor needs a good balancing plan and good lot control to get the work out, to deal with rush priorities with a minimum of disturbance, and to meet the production schedules while producing good quality work.

These programs are designed to teach supervisors the fundamentals of the specialized skill areas that are under their jurisdiction. Although each plant has its own policies, the programs present a general picture of the basic elements of the supervisor's job which can be applied to almost any situation. The program's purpose is to introduce and reinforce standards of excellence for the supervisors - the men and women responsible for producing quality products on the factory floor.

VIDEO TAPE LIBRARY FROM S.E.A.M.S.

The following tapes are avaliable from Southeastern Apparel Manufacturers and Suppliers, Columbia, SC.

1. Supervisory Self-Appraisal
2. Supervisory Planning and Control
3. Discipline
4. The Supervisor's Role in Preventing Employee Pilferage
5. The Supervisor's Role in Quality Control
6. Controlling Time Waste
7. How to Get the Most Out of Marginal Employees
8. The Supervisor's Role in Increasing Productivity
9. Automatic Attachments and Workstations
10. The Supervisor's Role in Employee Privacy
11. Working with Difficult People
12. How to Give Orders
13. The Business of Paradigms

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